

**EPA Superfund
Record of Decision:**

**CHEROKEE COUNTY
EPA ID: KSD980741862
OU 06
GALENA, KS
09/30/2004**

RECORD OF DECISION

CHEROKEE COUNTY SUPERFUND SITE
BADGER, LAWTON, WACO, AND CRESTLINE SUBSITES
OPERABLE UNIT #06

CHEROKEE COUNTY, KANSAS

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September 2004

40161798



SUPERFUND RECORDS

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RECORD OF DECISION

DECLARATION

SITE NAME AND LOCATION

Badger, Lawton, Waco, and Crestline Subsites, Operable Unit #06 (OU-6)
Cherokee County Superfund Site
Cherokee County, Kansas

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for mining wastes at OU-6 of the Cherokee County Superfund site. This decision was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for the site. The Administrative Record file is located at the following information repositories:

Columbus Public Library
205 North Kansas Avenue
Columbus, Kansas

U.S. Environmental Protection Agency
901 North 5th Street
Kansas City, Kansas

The state of Kansas concurs with this selected remedy. Additionally, the U.S. Fish and Wildlife Service concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), present a current threat to public health, welfare, or the environment. The site contains heavy metals in various environmental media resulting from historic lead-zinc mining and processing.


DESCRIPTION OF THE SELECTED REMEDY

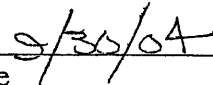
The U.S. Environmental Protection Agency (EPA) believes the selected remedy (Alternative 4A with an estimated cost of 7 million dollars) appropriately addresses the principal current and potential risks to human health and the environment. The remedy addresses ecological and human health risks by the remediation of surficial mining wastes and sediments impacted by heavy metals. The major components of the selected remedy for the four subsites (Badger, Lawton, Waco, and Crestline) include the following actions.

- Excavate, consolidate, and/or cap all surficial mining wastes and excavate metals-impacted sediments from subsite streams followed by disposal and capping.
- Utilize subaqueous mine waste disposal to the maximum extent practicable, with the exception of remedial actions at the Badger subsite. For the Badger subsite, excavate mining wastes and dispose of materials in conventional repositories located beyond the limits of the 100-year flood plain of the Spring River.
- Abandon deep wells to prevent cross-contamination between the shallow and deep aquifers.
- Characterize and monitor the groundwater flow system for assessment of the subaqueous mine waste disposal components of the remedy.
- Adopt institutional controls for future development as specified in an earlier ROD.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state laws that are legally applicable or relevant and appropriate requirements (ARARs) for the remedial action, and is cost effective. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, but may not satisfy the statutory preference for treatment as a principal element because of the large volume and potentially expensive methods to stabilize or treat the mining wastes and the effectiveness of non-treatment alternatives. Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.


Cecilia Tapia, Director
Superfund Division


Date

RECORD OF DECISION

DECISION SUMMARY

SITE NAME, LOCATION, AND DESCRIPTION

The Cherokee County Superfund site (CERCLIS I.D. # KSD980741862) spans 115 square miles and represents the Kansas portion of the former Tri-State mining district. The Cherokee County Superfund site is arranged into seven operable units (OUs) for administrative efficiency in conducting environmental cleanups: OU-1, Galena Alternate Water Supply; OU-2, Spring River Basin; OU-3, Baxter Springs subsite; OU-4, Treece subsite; OU-5, Galena Groundwater/Surface Water; OU-6, Badger, Lawton, Waco, and Crestline subsites; and OU-7, Galena Residential Soils. The Cherokee County site is depicted on Figure 1.

This ROD is concerned solely with OU-6, consisting of the Badger, Lawton, Waco, and Crestline subsites that are located in the northern portion of the site and are shown on Figures 2 and 3. Contaminated media at the OU-6 subsites include mining wastes, sediments, soils, groundwater, and surface water. The contaminants of concern are zinc, lead, and cadmium. The contamination was caused by lead and zinc ore mining and processing that began in Kansas in the 1870s and continued until 1970. The mining and processing generated chat piles and tailings, collectively known as milling wastes, that are the sources of the contaminants of concern.

The EPA is the lead agency and the state of Kansas, the Kansas Department of Health and Environment (KDHE), is the support agency for this remedy selection. The sources of cleanup monies will likely include the Superfund Trust Fund, state of Kansas cost share, and enforcement/ responsible party funding and/or work.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The EPA placed the Cherokee County Superfund site on the National Priorities List (NPL), set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on September 8, 1983, 48 Fed. Reg. 40658. Subsequent to the NPL listing, investigation of the subsites has consisted of a remedial investigation and feasibility study (RI/FS), a subaqueous mine waste disposal pilot study, site inspections, and sample collection/analysis by the EPA and the KDHE. Currently, no remedial actions have taken place at the subsites. However, the subject of this ROD is the selection of the appropriate remedial action to be taken at the subsites.

The EPA, through its enforcement authorities, negotiated an Administrative Order on Consent (AOC) with certain potentially responsible parties (PRPs) to conduct the RI/FS for the subsites. The PRPs performing the RI/FS under the AOC were Cyprus Amax Minerals

Corporation (corporate successor is currently Phelps Dodge Corporation), E.I. du Pont de Nemours and Company (Dupont), NL Industries, Inc., and Sun Company, Inc. In performance of the RI/FS under that AOC, the PRPs were partially compensated from certain proceeds from the EPA's settlements in connection with the bankruptcy of Eagle Picher Industries, Inc., which was another PRP for the subsites.

During the course of the RI/FS for the subsites, as well as for work at other subsites within the greater Cherokee County Superfund site, the EPA and the KDHE have conducted numerous public meetings and availability sessions, distributed and mailed factsheets, and have been interviewed by local print and broadcast media outlets. Additionally, several site tours have been conducted for many diverse groups inclusive of federal and state agencies, universities, professional organizations, and political entities. Efforts were made to solicit views on reasonably anticipated future land use and potential beneficial uses of groundwater during the RI/FS phase and at the public meeting for the Proposed Plan on June 22, 2004.

COMMUNITY PARTICIPATION

The public was encouraged to participate in the Proposed Plan and ROD process at OU-6 and has historically been made aware of the environmental issues in the county through the many public meetings, public availability sessions, newspaper articles, television coverage, radio broadcasts, and press releases that have occurred at the site for the many environmental cleanups conducted to date. In order to provide the community with an opportunity to submit written or oral comments on the OU-6 Proposed Plan, the EPA established an initial 30-day public comment period from June 7 to July 6, 2004. This comment period was expanded an additional 30 days to August 6, 2004 pursuant to a PRP request for an extension. A public meeting was held on June 22, 2004, at 7:00 p.m. at the Cherokee County Health Department, 110 East Walnut Street, Columbus, Kansas, to present the Proposed Plan, accept written and oral comments, and to answer any questions concerning the proposed cleanup remedy. Nearly 40 people attended the public meeting and the event was covered by local newspaper and television affiliates. A summary of the verbal questions received at the public meeting, inclusive of responses, is provided in the attached Responsiveness Summary. The Responsiveness Summary also contains a summary of written correspondence received during the public comment period as well as written responses to that input.

The Proposed Plan and supporting Administrative Record file were made available for public review during normal business hours at the Columbus Public Library in Columbus, Kansas, and at the EPA's office in Kansas City, Kansas. Additional administrative record files supporting the EPA's historic cleanups at the Baxter Springs/Treece subsites and Galena subsite are also available at the EPA's office and at the Johnston Public Library in Baxter Springs, Kansas, and the Galena Public Library in Galena, Kansas, respectively. These additional administrative records are incorporated into the OU-6 Administrative Record by reference. Moreover, the OU-6 Administrative Record has been updated with additional information (September 2004 addendum) to support this ROD.

SCOPE AND ROLE OF OPERABLE UNITS

The Cherokee County site is arranged into the following seven OUs for administrative efficiency in conducting environmental cleanups: OU-1, Galena Alternate Water Supply; OU-2, Spring River Basin; OU-3, Baxter Springs subsite; OU-4, Treece subsite; OU-5, Galena Groundwater/Surface Water; OU-6, Badger, Lawton, Waco, and Crestline subsites; and OU-7, Galena Residential Soils. A brief overview of the status of each Cherokee County operable unit is provided below:

OU-1: Galena Alternate Water Supply - This OU is in the long-term operation and maintenance (O&M) phase. The completed EPA funded cleanup consisted of providing a permanent water supply to over 400 residences by the installation of deep aquifer drinking water supply wells and the formation of a rural water district. The district has expanded by over 100 new hook ups (> 500 total) since the cleanup was completed in 1994 and serves the rural areas of Galena, Kansas.

OU-2: Spring River Basin - This OU consists of the Spring River in Kansas, and as such, it is directly influenced by the other subsite cleanups at the Cherokee County site as well as upstream cleanups planned for the Jasper County, Missouri, Superfund site. The work is in the characterization phase and will likely represent the final area to be addressed at the Cherokee County site.

OU-3: Baxter Springs Subsite - This cleanup was completed and transitioned to the O&M phase in 2004. The work included the remediation of over 160 acres of mining wastes inclusive of the removal of impacted stream sediments from Spring Branch and a tributary to Willow Creek. Spring Branch and Willow Creek are tributaries of the Spring River. The cleanup also included the abandonment of deep aquifer wells, the remediation of over 40 residential properties, and the characterization of over 300 properties. This cleanup was fully funded and performed by PRPs.

OU-4: Treece Subsite - A residential cleanup was completed by PRPs at this subsite in 2000. Over 40 properties were remediated and approximately 150 properties were characterized. The mining waste cleanup aspect of this subsite was held in abeyance and is subject to re-opening in the future.

OU-5: Galena Groundwater/Surface Water - The EPA funded cleanup was completed in 1995 and the OU is in the long-term O&M phase. The work included the remediation of 900 acres of mining wastes and the abandonment of deep wells acting as a potential conduit for contaminants to migrate from the upper impacted aquifer to the lower pristine aquifer. A subsequent multi-year ecological study conducted by the University of Kansas Biological Survey indicated some improvement to Short Creek following the cleanup. The KDHE is currently evaluating ongoing O&M costs at this OU.

OU-6: Badger, Lawton, Waco, and Crestline Subsites - This ROD focuses on the Badger, Lawton, Waco, and Crestline subsites that are located in the northern portion of the site and are shown on Figures 2 and 3. These subsites represent locations of historic lead and zinc mining in the Tri-State mining district and are similar to the mine waste areas addressed at OU-3 and OU-5 of the Cherokee County site, except for OU-6 the Spring River tributaries are Cow Creek and Shawnee Creek. The RI/FS process has been completed, and OU-6 is at the decision document phase, currently the subject of this ROD.

OU-7: Galena Residential Soils - The EPA funded cleanup was completed in 2001 and is now in the long-term O&M phase. The work included the characterization of nearly 1,500 residential properties and the remediation of over 700 properties.

SITE CHARACTERISTICS

The physical characteristics of the subsites include the presence of nine shafts, mine subsidence pits, impoundment tailings, chat piles, overburden piles, collapse features, mine ponds, and bull rock piles. Milling wastes are grouped into two broad categories, chat and tailings, while non-milling wastes are also grouped into the two categories of overburden and bull rock. Chat is composed of gravel- and sand-sized materials that are typically found in large piles while tailings are fine-, silt- to clay-sized, wastes that are typically found in areas impounded by berms or dikes. Chat and tailings are the hazardous source materials of concern due to elevated levels of heavy metals, especially zinc, lead, and cadmium. They are the residual bedrock, or host ore body, materials remaining from the milling process.

Overburden is typically found in piles composed of large boulder-sized material predominantly comprised of shale and limestone. This non-hazardous material was removed or excavated in order to reach the deeper ore bearing zones. Bull rock is a local term for the cobble to boulder sized material typically found in cone-shaped piles and comprised of cherty limestone and breccia. Bull rock is material that did not meet milling requirements and may also consist of overburden materials removed prior to reaching the prime ore bearing zones. Bull rock may exhibit low-grade mineralization but is generally considered non-hazardous.

The mining areas also contain many ponds, pits, collapses, and shafts that are water-filled and contain surface water and/or groundwater depending upon the characteristics of the individual features. The pits and collapse features develop due to the extensive amount of undermined areas within the subsites. These features are a result of ground collapse in an area underlain by subsurface room and pillar mining. The mine shafts were used for access and ore extraction and there are also many exploration drill holes and air shafts within the subsites. Open shafts, pits, collapses, and ponds receive heavy metals laden runoff from mine tailings and chat piles in many instances.

The major geographic features impacting remedy selection are the Spring River, its tributaries, and certain ponds. These surface water bodies are influenced by subsite waste and adversely affect aquatic life, and possibly waterfowl. The Spring River is a major interstate stream and is located approximately one mile to the east of the site. All of the subsites are within the Spring River drainage basin and all surface flows are to the Spring River or its tributaries. Cow Creek and Shawnee Creek are the two primary tributaries of the Spring River in Kansas and they flow to the south prior to entering the Spring River. Cow Creek enters the Spring River about one to two miles south of Lawton, Kansas, and Shawnee Creek enters the Spring River near Riverton, Kansas. These tributaries are plains-type streams underlain by Pennsylvanian age shale, and as such, base flows are poorly sustained by groundwater recharge during dry seasons. The KDHE chronic aquatic life criteria have been exceeded in Cow Creek and Shawnee Creek. Additionally, mining related zinc load. contributions to the Spring River are provided by Turkey Creek and Center Creek, predominantly from mining-impacted areas in Missouri.

The subsites are underlain by two aquifers that are separated by a confining unit. The upper aquifer is locally called the Boone Aquifer and is a Mississippian age limestone unit that exhibits water table conditions, except for areas overlain by Pennsylvanian age shale deposits where semi-confined to confined aquifer conditions exist. The lower carbonate aquifer, known as the Roubidoux, is confined, and the regional groundwater flow direction is west to northwest. Public water supply districts provide water from the deep aquifer to most residents of the subsites. A small number of households have shallow private wells in the Boone Aquifer and the water quality of these sources was tested and found to be acceptable during earlier phases of the work conducted at the subsites. Shallow groundwater in the mine workings typically exceeds water quality standards but the extent of the impacted groundwater has not been characterized to date.

Past practices in the greater Cherokee County Superfund site have resulted in chat being distributed to residential yards as fill or driveway material. However, sampling of residential yards in proximity to the mining wastes in the subsites did not identify any residential properties that required remediation, as has occurred at other subsites in Cherokee County.

The extent of the chat piles, tailings impoundments, and sediments impacted by the mining wastes, is depicted on the attached maps of the area (Figures 2 through 7). Streams and ponds are depicted as well. All surface water flows in the area of the subsites are to the Spring River or its two primary tributaries, Cow Creek and Shawnee Creek.

The primary source material for principal threats to the subsites are the chat piles and tailings, as well as some stream sediment areas where the mine waste materials have washed into the streams. The volume of the chat and tailings is estimated in the range of 1.8 to 2.3 million cubic yards.

CURRENT AND POTENTIAL FUTURE LAND USE AND RESOURCE USES

Currently the subsites are accessible by gravel roads, or by foot. An unused rail line traverses the general area, as does the Spring River and its tributaries. The current and expected future use of the area is agricultural, primarily farming and grazing, but the areas of chat piles, tailings, ponds, pits, and subsidence areas are not vegetated and are essentially unused by humans. While some chat piles in the greater Cherokee County Superfund site have been exploited commercially to supply aggregate for roadway construction, no chat piles in the subsites are currently used to supply aggregate. Some residences are near the subsites. Maps of the subsites (Figures 2 and 3) depict the major features of the area.

SUMMARY OF SITE RISKS

Ecological Risks

Ecological risks constitute the primary site risks and are present due to elevated levels of heavy metals in mining wastes, soils, sediments, groundwater, and surface water within the subsites. The primary exposure route consists of the uptake of heavy metals by ecological receptors such as fish, macro-invertebrates, birds, and other terrestrial species. Zinc, lead, and cadmium are the major contaminants of concern for ecological receptors and also represent the principal threats. Ecological receptors are exposed to heavy metals primarily by ingestion of impacted mine wastes, soils, surface water, vegetation, and prey as well as inhalation of toxic dusts. Toxicity quotients, a measure of ecological risk, have been calculated in many former mined areas of the Tri-State mining district and they indicate the presence of ecological risks (toxicity quotient values > 1). Additionally, recent studies by the U.S. Fish and Wildlife Service indicate mining impacts to migratory waterfowl and wild birds.

The average concentrations of heavy metals in Cherokee County, Kansas, chat mining wastes are 8,300 parts per million (ppm) zinc, 750 ppm lead, and 46 ppm cadmium, and the average concentrations in tailings are 21,600 ppm zinc, 3,800 ppm lead, and 124 ppm cadmium, as based on the RI at OU-3/4. Maximum values of heavy metals in chat mining wastes are 13,000 ppm zinc, 1,660 ppm lead, and 89 ppm cadmium, while the maximum values for tailings are 52,000 ppm zinc, 13,000 ppm lead, and 540 ppm cadmium, as based on the OU-3/4 RI report.

Sediment data from OU-6 have shown maximum values of 29,500 ppm zinc (Waco subsite), 675 ppm lead (Crestline subsite), and 182 ppm cadmium (Waco subsite), as based on the OU-6 RI report, while mine waste data from the Waco, Missouri, area adjacent to OU-6 yield maximum values of 13,300 ppm zinc, and 1,500 ppm lead based on field data from the Crestline subsite. Average chat mine waste values of 12,675 ppm zinc, 159 ppm lead, and 89 ppm cadmium have been reported in the OU-6 FS report for the Waco, Missouri, area adjacent to a portion of OU-6.

Whole body fish tissue samples were analyzed at OU-6 during the RI and yielded the following maximum wet-weight values: 167 ppm zinc at the Crestline subsite; 1.81 ppm lead at the Waco subsite; and 0.371 ppm cadmium at the Lawton subsite. Reference values for locations in the Spring River upstream of Waco, Missouri, as reported in the OU-6 RI; consist of the following for non-bottom feeding and bottom-feeding species, respectively: 45.83 to 57.43 ppm zinc; 0.759 to 1.421 ppm lead; and 0.184 to 0.224 cadmium.

Human Health Risks

Human health risks are present due to elevated levels of heavy metals in the same media described above. The contaminants of concern are the same (zinc, lead, and cadmium); however, the principal threats for human health risks are lead and, to a lesser degree, cadmium. The wastes are located in rural areas and all nearby homes have been sampled for heavy metals in residential yard soils and all known households with private water wells have been tested; all of the residential yard soil and groundwater results have been below levels of concern. Thus; primary human health risks include the use of mining wastes or residential applications, future residential development, and trespassing. These risks are less of a concern as contrasted to ecological risks due to the remote nature of the subsites and the lack of new or proposed residential construction in the area. Trespassing would likely consist of hunting, fishing, and the illegal disposal of refuse, and as such, would not likely constitute a significant human health risk.

It is the EPA's current judgement as lead agency that the selected alternative identified in this ROD is necessary to protect public health or welfare of the environment from actual or threatened releases of hazardous substances into the environment. This view is also held by the KDHE, the support agency representing the state of Kansas, as well as the U.S. Fish and Wildlife Service.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are cleanup goals that are addressed by reducing or eliminating contaminants or exposure routes. RAOs are media-specific and are provided in Table 1. There are seven total RAOs; two for soils and source materials, two for surface water and sediments, and three for groundwater.

The soils and source materials RAOs specify the prevention of ecological and human health risks associated with the exposure to soils and mining waste source materials containing heavy metals. These RAOs are met by relocating, consolidating, disposing, and capping all surface accumulations of soils and mining waste source materials. The contaminated media will be rendered inaccessible by human or ecological receptors and thus the RAOs will be satisfied.

The surface water and sediment RAOs specify the prevention of ecological risks by reducing the exposures related to metals-impacted surface water and sediment. The excavation, disposal, and capping of sediments exceeding risk- or background-based levels will remove the

threat to ecological receptors. Implementing these RAOs, in combination with the soil and source materials actions, will reduce or eliminate the sources and levels of heavy metals in surface water.

The groundwater RAOs specify the prevention of human health and ecological risks resulting from metals-impacted groundwater. Preventing the downward migration of contaminants to the lower aquifer by sealing deep wells or boreholes that act as conduits, in combination with the reduction or elimination of groundwater impacts via the soils and source materials RAOs, will result in improvements to the groundwater system.

For OU-6, the proposed remedial action is primarily expected to accomplish a reduction of lead, cadmium, and zinc loading on the Spring River and its tributaries, in both the surface waters and in the sediments. Moreover, the complete removal of impacted sources eliminates ecological and human health risk pathways and reduces or eliminates the degradation of groundwater via source removal. Currently, human exposure via residential soils and groundwater in the proximity of the subsites does not exceed action levels. The human health and ecological risks are associated with non-residential mining wastes. The proposed remedial action does not include new or additional institutional controls because they are specified on a county wide basis in a prior ROD. Adoption of these existing controls is a component of this ROD where deemed necessary.

DESCRIPTION OF ALTERNATIVES

Various cleanup alternatives were evaluated in order to select the optimum approach to address site risks. A total of six candidate alternatives were initially screened during the FS process and five of these approaches were carried forward for a more detailed assessment of their viability. The five cleanup alternatives subjected to a detailed analysis are described on Table 2 and were developed in order to address the site-specific RAOs. Each of the five potential alternatives, in addition to an alternative developed by the EPA as a modification of Alternative 4, designated as Alternative 4A, are briefly summarized in the following paragraphs. Alternative 3 is not included since it was not carried forward for a detailed assessment in the FS report. More detailed information regarding the various alternatives is available in the FS and Administrative Record file.

Alternative 1: No Further Action - This remedy is required for evaluation as a baseline approach in order to fully assess and compare the other more protective remedies. This approach does not include any active engineering or remedial activities to address the RAOs and site risks. The remedy includes some amount of basic water quality monitoring on Spring River, Cow Creek, and Shawnee Creek in addition to the implementation of an institutional controls program addressing the following elements: restrictions on new residential development in mine waste areas; restrictions on the drilling and installation of new domestic water supply wells; encouragement of local citizens to utilize existing rural water districts for domestic needs; and the implementation of casing integrity standards and oversight for the design and construction of

new deep aquifer supply wells. These institutional controls are adopted from the ROD for OU-3/4, the Baxter Springs and Treece subsites, dated August 1997. The estimated capital and O&M costs for this remedy are less than \$500,000.

Alternative 2: Water Management and Erosion Controls - This alternative includes the actions described in Alternative 1 and also addresses surface water and sediment RAOs by implementing engineering drainage, water management, and erosion controls in addition to excavation and on-site containment (consolidation and capping) of selected source materials (mill wastes and sediments) in order to reduce metal and sediment loads to classified perennial streams and rivers with a secondary goal being the reduction of loads to ephemeral tributaries. This approach includes limited sediment removal from ephemeral stream channels that contribute significant metal and sediment loads to state-listed streams and also includes the abandonment of deep aquifer wells to prevent cross-contamination between the impacted shallow and pristine deep aquifers. The water management aspects involve diversion of clean runoff around mined areas and detaining on-site runoff utilizing berms, dikes, swales, and detention ponds. This alternative reduces metal and sediment loadings but is not intended to meet Kansas surface water aquatic life criteria and does not address all accumulations of surficial wastes. This approach is similar to the cleanup approach conducted at the Baxter Springs subsite (OU-3) of the Cherokee County site and is thus not expected to meet all ARARs, particularly chemical-specific ARARs (Kansas surface water aquatic life criteria). The estimated capital and O&M costs are less than \$3,000,000.

Alternative 4: Source Removal and Subsidence Pit Disposal- This alternative includes the actions prescribed by Alternatives 1 and 2 and expands the cleanup to include all mill wastes and channel sediments that are actively contributing metals or sediment loads to surface waters. This alternative utilizes mine subsidence features to the maximum extent practicable as permanent repositories for excavated mill and sediment mining wastes, in addition to conventional consolidation and capping methods. However, subsidence pit disposal is not employed as an approach near streams or flood plains and is thus not included in the actions for the Badger subsite due to the possible impacts to the Spring River as a result of subaqueous mine waste disposal. Mine wastes at the Badger subsite will be excavated and relocated to repositories above the 100-year flood plain of the Spring River. All wastes contributing to Kansas aquatic life criteria exceedances would be addressed by this approach. This alternative addresses a greater amount of surficial wastes as contrasted to Alternative 2 but does not address all surficial accumulations. Ecological risks posed by existing non-remediated areas of mining wastes would not be addressed by this remedy and human health risks related to these remaining accumulations would be reliant upon institutional controls that are not currently enacted. The estimated capital and O&M costs are \$5,000,000.

Alternative 4A: Complete Source Removal, Capping, and Subsidence Pit Disposal- This alternative includes identical actions specified in Alternative 4 at the Badger, Lawton, and Crestline subsites. Alternative 4A modifies the Alternative 4 approach at the Waco subsite to include all surficial mining wastes (approximately 100 additional acres). Alternative 4 addresses

all surficial wastes at the Badger, Lawton, and Crestline subsites, but specifies a lesser remediation of mining wastes at the Waco subsite. Alternative 4A expands Alternative 4 by addressing all surficial mining wastes at the Waco subsite and is thus consistent with the actions conducted at the remaining subsites. Additionally, Alternative 4A includes the use of numeric standards for sediment remediation and the assessment and potential mitigation of sediment impacts associated with water-filled features (ponds, collapses, pits, etc.) remaining on-site following the cleanup. The capital and O&M costs for Alternative 4A are estimated at \$7,000,000.

Alternative 5: On-site Containment and Erosion Control - This alternative includes the actions described in Alternatives 1 and 2 in addition to conventional excavation, consolidation, and capping of excavated mill wastes and sediments contributing to aquatic life criteria exceedances. This alternative is identical to Alternative 4 in that it addresses wastes contributing to Kansas surface water aquatic life criteria exceedances, but it does not employ subaqueous mine waste disposal. All wastes are consolidated and capped above the ground surface and some wastes may be capped in-place. This alternative addresses a greater amount of surficial wastes as contrasted to Alternative 2, an identical amount as Alternative 4, but does not address all surficial accumulations. Ecological and human health risks remain as discussed for Alternative 4. The estimated capital and O&M costs for Alternative 5 are \$5,000,000.

Alternative 6: Source Removal and On-site Disposal - This alternative includes the actions described in Alternatives 1, 2, and 5 in addition to addressing all surficial wastes by placement of excavated wastes into engineered repositories and employing various multi-layered capping designs for repositories and capped subsidence pits in order to completely reduce infiltration. This remedy is the most comprehensive as it addresses all surficial wastes, requires excavation of all wastes, and specifies the construction of engineered repositories with sophisticated cap designs for all excavated materials. Alternative 6 prohibits subaqueous mine waste disposal at all subsites except the Waco subsite, and the technology is minimized to the extent practicable at this subsite. This alternative would meet all ARARs and be protective of all human and ecological receptors. The estimated capital and O&M costs are greater than \$10,000,000.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP requires the EPA to evaluate selected remedial alternatives considering nine criteria. Any selected or preferred remedy must satisfy all nine criteria before it can be implemented. The nine criteria are divided into the following groupings: two threshold criteria; five balancing criteria; and two modifying criteria. The two threshold criteria are overall protection of human health and the environment and compliance with ARARs. Generally, alternatives must satisfy the two threshold criteria or they are rejected without further considering the remaining criteria. The five balancing criteria consist of the following: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume achieved through treatment; implementability; short-term effectiveness; and cost. Lastly, the two modifying

criteria consist of state and community acceptance. The modifying criteria were fully evaluated following state and public input as discussed in this document and the Responsiveness Summary (Attachment 1).

Threshold Criteria Evaluation

The threshold criteria of overall protection of human health and the environment and ARARs compliance addresses whether a remedy provides adequate protection by reducing, eliminating, or controlling pathway risks through treatment, engineering, and institutional controls in addition to meeting the ARARs of federal and state laws. Compliance with chemical-specific, location-specific, and action-specific ARARs is required unless a site-specific waiver is justified. This site does not justify the waiver of any ARARs.

The selected remedy is a modified version of Alternative 4, with costs estimated at 7 million dollars, and is designated as Alternative 4A (Complete Source Removal, Capping, and Subsidence Pit Disposal). This alternative will meet the threshold criteria of protecting human health and the environment and complying with ARARs through the implementation of engineering controls. Excavation, consolidation, subaqueous disposal, capping, capping in place, and re-vegetation of all surficial mine waste accumulations, in conjunction with the excavation of impacted sediments, will eliminate human and ecological (terrestrial/aquatic organisms and birds) risks by engineering methods. Additional remedy components include the characterization of groundwater conditions, plugging of deep wells, and assessment of non-stream (ponds, pits, collapses) sediments followed by potential capping. All chemical-, location-, and action-specific ARARs will be met by the preferred alternative.

Potential Alternatives 1 (No Action) and 2 (Water Management and Erosion Controls) do not meet the threshold criteria of protecting human health and the environment and complying with ARARs. Alternative 1 does not include any engineering actions and basically relies upon monitoring to continue to evaluate site conditions in addition to institutional controls. These actions would not be protective of human health and the environment and would not comply with ARARs. Alternative 2 specifies limited engineering actions and is not designed to meet ARARs nor would it provide optimum protection of human health and the environment. An ARARs waiver is not contemplated for this cleanup. Alternatives 1 and 2 do not satisfy the threshold criteria.

Potential Alternatives 4 (Source Removal and Subsidence Pit Disposal) and 5 (On-site Containment and Erosion Control) do not satisfy the threshold criteria as Alternatives 4A and 6 because they do not address all surficial wastes in all subsites and thus would not be fully protective of ecological and human receptors. Alternatives 4 and 5 meet the threshold criteria in the Badger, Lawton, and Crestline subsites, but do not meet the criteria in the Waco subsite. All surficial mine waste accumulations were not addressed by this alternative at the Waco subsite in contrast to the other three subsites. Additionally, human health risks in areas of existing mine wastes would be subject to reliance on institutional controls that have not been enacted, as opposed to engineering controls, and are thus considered less protective.

Potential Alternative 6 (Source Removal and On-site Disposal) meets the threshold criteria by addressing all surficial mining wastes, maximizing the degree of mine waste excavation and consolidation, and employing the use of sophisticated engineered cap and cover designs for maximum infiltration reduction. The remaining assessment of balancing and modifying criteria will focus on alternatives that optimally satisfy the threshold criteria: Alternatives 4A and 6.

Balancing Criteria Evaluation

Descriptions of the five balancing criteria include the following: long-term effectiveness and permanence addresses the ability of a remedy to maintain protection of human health and the environment over time, inclusive of residual risks following implementation; reduction in toxicity, mobility, or volume through treatment addresses the degree to which a remedy employs recycling or treatment methodologies to control principal threats; implementability describes the technical and administrative feasibility of implementing a cleanup approach including the difficulty of undertaking additional follow-on actions; short-term effectiveness addresses the time required for implementation and any adverse impacts during implementation; and cost describes the direct and indirect capital costs of the alternative. The balancing criteria are applied to potential remedies that satisfy the earlier threshold criteria and are thus moved forward for additional evaluation. Therefore, Alternatives 4A and 6 will be exclusively discussed in the balancing criteria evaluation.

Alternatives 4A and 6 meet all five of the balancing criteria although distinctions exist. Alternative 4A may potentially have a lesser degree of long-term effectiveness and permanence as contrasted to Alternative 6 due to the relatively novel approach of subaqueous mine waste disposal. A recent pilot study did not conclusively illustrate the long-term effectiveness and permanence of subaqueous mine waste disposal due to ongoing potential concerns related to groundwater impacts. This approach is not suitable in areas adjacent to streams or in highly transmissive aquifer materials. However, the pilot study results appear sufficient to employ this remedy in a larger scale remedial application as a technology demonstration or validation approach. Alternative 6 would have a greater surficial area to maintain, and thus may also have issues with the long-term maintenance aspects of the engineered caps. Alternative 4A has an advantage of a lesser area subject to long-term maintenance, providing the underlying groundwater does not become an issue.

Alternative 4A may potentially not have the degree of reduction of toxicity or mobility of contaminants as contrasted to Alternative 6 based on the earlier discussion of potential groundwater impacts over time. Both remedies do not employ treatment; however, Alternative 4A may prove to constitute treatment pending additional evaluations of geochemical conditions over time. Many large area lead site remedial actions do not satisfy the treatment preference due to the presence of large volume of wastes dispersed over great areas. Alternative 4A has an advantage of possibly demonstrating the technical effectiveness of a new technology, subaqueous mine waste disposal, that may have great utility at future sites. Alternative 6 provides the greatest reduction of toxicity and mobility by employing sophisticated caps that essentially alleviate infiltration.

Both remedies are easily implemented but Alternative 4A has advantages over Alternative 6 in this regard. Each remedy utilizes standard construction equipment; however, Alternative 6 will take longer than Alternative 4A to construct; thus, Alternative 4A is favored with regard to time for implementation. Additionally, Alternative 4A utilizes a smaller area for remediation as contrasted to Alternative 6, and thus may be more amenable to affected landowners.

Alternative 4A has short-term impacts due to the potential increase in groundwater concentrations of heavy metals following subaqueous disposal. However, Alternative 6 may also have equal or greater short-term impacts as it requires a longer implementation time frame and involves the excavation and transportation of large volumes of materials.

Alternative 4A is more favorable than Alternative 6 with regard to cost. Alternative 4A, with estimated capital and operation and maintenance costs of 7 million dollars, is less costly than Alternative 6 which has an estimated cost greater than 10 million dollars.

In summary, Alternative 4A is favored in regard to cost and implementability while Alternative 6 is favored in regard to long-term effectiveness and permanence and reduction in toxicity and mobility through treatment. However, Alternative 4A may prove to be as successful in long-term effectiveness and reliability, may satisfy the treatment preference, and the implementation would serve as a valuable remedial-scale test of a promising new technology. Both remedies appear essentially equal in regard to short-term effectiveness.

Modifying Criteria Evaluation

The two modifying criteria of community and state acceptance are intended to assess the views of both groups regarding various cleanup approaches. The state of Kansas is represented by the KDHE and the public is represented by the local affected community. Views of the state are well known since the KDHE has been involved in many aspects of the project to date. Community views are fairly well known based on interactions with local land owners, local government officials, and similar situations at nearby subsites of the Cherokee County Superfund site that have historically been through this similar process.

Alternatives 4A and 6 are expected to be acceptable to the public and are known to be acceptable to the state of Kansas. The public has historically expressed a desire for environmental remedies that address all surficial accumulations of mining wastes and both of these alternatives meet these desires. The state of Kansas has recently expressed a similar desire that all surficial mining wastes be addressed and this preference is also met by both of these remedies. Alternative 4A may potentially have greater public acceptance since it involves filling many open mine collapse features which are typically sites for the dumping of refuse by unauthorized trespassers and also present physical hazards. Additionally, Alternative 4A will have a smaller area of remediated land requiring long-term O&M and thus may be more desirable to the KDHE and the public as compared to Alternative 6. Alternative 4A would return a greater

acreage of land back to productive agricultural use since the remedy involves greater consolidation and the use of subaqueous disposal as contrasted to above ground disposal methods specified by Alternative 6. The KDHE has expressed support for Alternative 4A and the U.S. Fish and Wildlife Service has also expressed a similar view.

PRINCIPAL THREAT WASTES

Principal threat wastes are source materials that require remediation based on toxicity, mobility, and the potential to create unacceptable human health or ecological risks. The NCP establishes a preference that treatment will be used to address principal threat wastes when practical. Treatment will not be employed at this site due to the widespread nature of the contaminants, large volumes of materials, and the effectiveness of non-treatment technologies (excavation, consolidation, capping, re-vegetating, subaqueous disposal) for the remediation of mining wastes. It should be noted that subaqueous mine waste disposal may constitute treatment if altered geochemical conditions are established. This aspect of the remedy will be assessed over time.

The principal threat wastes at the subsites consist of mining wastes and mining impacted sediments. The total volume of principal threat wastes at all four subsites is estimated at approximately two million cubic yards. Mining wastes may be segregated into two distinct types of materials, chat and tailings, and these materials ultimately impact surface water, groundwater, sediments, and soils. The chat and tailings are milling wastes and their characteristics are discussed in the earlier site characteristics portion of this document. The contaminants of concern are zinc, lead, and cadmium.

SELECTED REMEDY

The selected cleanup approach for addressing the mining waste impacting OU-6 subsites is a modified version of Alternative 4 (Source Removal and Subsidence Pit Disposal), which is designated as Alternative 4A (Complete Source Removal, Capping, and Subsidence Pit Disposal). The modifications to the original Alternative 4 include the remediation of all surficial mine waste accumulations at the Waco subsite by a combination of excavation, subaqueous mine waste disposal, consolidation with capping, and capping in place. Alternative 4A is identical to Alternative 4 at the other three subsites (Badger, Lawton, and Crestline). Alternative 4A addresses all waste accumulations inclusive of sediment, employs subaqueous mine waste disposal to the maximum extent practicable, and allows flexibility with regard to capping in place or consolidation and capping. It does not mandate the excavation of all materials or the use of sophisticated total infiltration-preventing cap designs as required by Alternative 6 nor does it prevent or minimize the use of subaqueous mine waste disposal as Alternatives 5 and 6 specify. It does not contemplate an ARARs waiver as Alternative 2 would likely require and it is an engineering solution as contrasted to Alternative 1, the No Action approach. It is expected that Kansas aquatic life criteria will be met by the actions prescribed by Alternative 4A and risks will be reduced in the most effective manner due to the flexibility of capping in place, consolidating and capping, excavating, and using subaqueous mine waste disposal, based on engineering efficiencies.

The remedial criteria for addressing surficial non-residential mining wastes is the visual presence of the materials, there are no specific action levels for the various heavy metals. This criteria is consistent with prior non-residential mine waste cleanups conducted at the Cherokee County site. The criteria for addressing sediments (non-surficial wastes) are threshold effects concentration (TEC) values from MacDonald et. al. (2000) that consist of the following action levels: cadmium = 0.99 ppm; lead = 35.8 ppm; and zinc = 121 ppm. Alternatively, site-specific sediment action levels may be established based on the determination of local non-mining impacted background reference sediment values subject to approval by the EPA with input from the KDHE and the U.S. Fish and Wildlife Service.

Certain limited areas of impacted sediment may not require removal based on the potential for destruction of critical habitat as indicated by prior use-attainability analyses conducted by the KDHE. Additional habitat assessment may be necessary during the design phase. Natural recovery will be employed for these relatively minor stream segments.

The specific elements of selected Alternative 4A include the following components for the Badger, Lawton, Waco, and Crestline subsites. Figures 4 through 7 depict the aspects of the selected alternative at each of the four subsites:

- Excavate, consolidate, and/or cap all surficial mine wastes and excavate metals impacted sediments from all ephemeral streams. Mining wastes in heavily forested, thickly vegetated areas will not be subject to excavating, consolidating, or capping.
- Utilize subaqueous mine waste disposal to the maximum extent practicable, with the exception of remedial actions at the Badger subsite due to the close proximity of the Spring River. For the Badger subsite, excavate mill wastes and dispose of materials in repositories located outside the limits of the 100-year flood plain of the Spring River.
- Cap subsidence pits, consolidation areas, tailings impoundments, and in-place chat/tailings areas utilizing topsoil and compacted clay caps with a minimum total thickness of 1.5 feet. The use of other materials in conjunction with soil, such as fly ash, is acceptable pending a successful assessment of viability.
- Re-contour and re-vegetate all disturbed areas and facilitate drainage and erosion controls. Construct sedimentation basins, detention ponds, dikes, berms, and swales to the extent necessary to control run-on and run-off.
- Abandon deep wells to prevent cross-contamination between the shallow and deep aquifers.

- Perform a design investigation to characterize the groundwater flow system in order to monitor the subaqueous mine waste disposal component of the remedy and to determine the need for groundwater institutional controls. County-wide institutional controls are addressed by other Cherokee County site decision documents and are not a component of this ROD.
- Assess the sediments of any water-filled shafts, pits, ponds, or collapse features not filled during the remedial action. Provide suitable cover, such as soil or rip rap, on near shore sediments that exceed numeric or site-specific criteria.
- Adopt the county-wide institutional controls from the Baxter Springs and Treece ROD, specifically, restrictions on new residential development in mine waste areas, controls on the drilling and design of new domestic water supply wells, and encouragement of local citizens to utilize existing rural water districts for domestic needs.

Based on the information currently available, the EPA, as the lead agency, and the KDHE as the supporting agency, believe the selected alternative optimally meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the selected alternative, Alternative 4A, to satisfy the following statutory requirements of CERCLA section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

The support agency, the KDHE, has been consulted in the preparation of this ROD, and has provided formal concurrence for the recommended cleanup alternative in this ROD. The U.S. Fish and Wildlife Service also supports the cleanup actions specified in this ROD. Additionally, certain aspects of the cleanup actions, such as the selection of a re-vegetation seed mixture, sediment removal and capping actions, and general remediation of surficial mining wastes, will be accomplished with U.S. Fish and Wildlife Service input in order to secure potential Natural Resource Damage (NRD) consideration granted by the U.S. Fish and Wildlife Service for the work performed under CERCLA. The intent is to conduct CERCLA response actions that return the site to a more natural condition and thus possibly convey substantial NRD consideration to those performing the work. The conveyance of NRD credits or consideration is not an EPA function; however, CERCLA response actions may be tailored in such a manner that the NRD Trustees (the U.S. Fish and Wildlife Service and the state of Kansas) may favorably assess the work in terms of natural resource restoration.

STATUTORY DETERMINATIONS

The EPA's primary legal authority and responsibility at Superfund sites is to conduct response actions that achieve adequate protection of human health and the environment. Section 121 of CERCLA also establishes other statutory requirements and preferences that include the need for federal and state ARARs compliance for selected remedial actions in addition to cost effectiveness and the use of permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable. Additionally, the statute includes a preference for remedies that reduce the mobility, toxicity, and volume of contaminants and include treatment. The following sections discuss how the selected alternative meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by achieving the RAOs through engineering measures. The institutional controls components of existing RODs will also complement the engineering controls specified by the selected alternative in terms of protecting human health.

Ecological risks resulting from exposure to mining wastes, heavy metals laden sediments, heavy metals impacted prey and food sources, and mining impacted surface waters will be addressed. by the excavation, disposal, and capping of impacted sediments and the excavation, consolidation, subaqueous disposal, and capping of surficial mining wastes. Mining impacted sediments and surficial mining wastes will no longer be present and thus unavailable for uptake by ecological receptors. Near-shore sediments associated with ponds, pits, and collapse features (non-stream sediments) will be assessed for these features that are not filled as part of the remedy, and any impacted sediments will be capped (soil or rip rap) to prevent exposure. The ecological risks at OU-6 will be addressed by engineering controls as specified in the selected remedy.

Human health risks resulting from the exposure to mining wastes via the importation and use of the uncontrolled wastes in residential scenarios, trespassing in areas of mine waste accumulations, and residential construction in or near mine waste areas, will be prevented by the physical relocation, consolidation, subaqueous disposal, and capping requirements under the selected remedy. Mining wastes will no longer be present at the surface, and as such, the existing human health risks will be eliminated by engineering controls and the potential future risks will also be addressed by the engineering actions. O&M requirements for the capped areas will also serve as controls on future use. The institutional controls components of an existing ROD, when fully implemented, will limit, or control, residential development in or near mine waste areas and also control the drilling and use of new water supply wells in mined areas.

Potential groundwater risks to human health will also be addressed by the abandonment of deep wells that act as conduits to allow contaminants in the upper aquifer to migrate to lower pristine sources of water. The selected remedy will also provide characterization of the upper

aquifer in order to more clearly delineate any areas of impacted groundwater that may be subject to future institutional controls and to also assist in the evaluation of the effectiveness of subaqueous mine waste disposal.

Compliance with ARARs

In general, selected remedies are expected to comply with ARARs unless waivers are granted. The selected remedy is expected to meet all chemical-specific, action-specific, and location-specific ARARs and does not include any waivers.

Chemical-specific ARARs provide health or risk based concentration limits for contaminants in various environmental media such as sediment, groundwater, and surface water. The chemical-specific ARARs for groundwater and surface water and the risk based criteria for sediments and surficial mining wastes are discussed below.

- Safe Drinking Water Act (SDWA) - 42 United States Code (U.S.C.), National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs), 40 Code of Federal Regulations (CRF), Part 141, and the Kansas Administrative Regulations (K.A.R.) 28-15-13 for Safe Drinking Water are relevant and appropriate requirements for this response action. MCLs are standards promulgated for the protection of public drinking water supplies and these levels, in addition to the Kansas standards, are relevant and appropriate cleanup goals. The upper and lower aquifers at the site are used for drinking water purposes. The following depict the MCLs established by the SDWA and Kansas standards for lead (Pb) and cadmium (Cd): Pb action level at the tap = 15 parts per billion (ppb); Cd MCL = 5 ppb.
- Secondary MCLs and Maximum Contaminant Level Goals (MCLGs) - These standards are to be considered in implementing the remedy. Secondary MCLs and MCLGs are standards for public drinking water supplies that provide taste, odor, and aesthetic qualities. These are non health-based criteria, and as such, they are to be considered and were published in 50 Federal Register 36936.
- EPA Guidance Document, Cleanup Level for Lead in Groundwater (1/15/93) - This guidance to be considered recommends a final cleanup level. of 15 ppb Pb in groundwater used for drinking water purposes and is consistent with SDWA and Kansas criteria. Groundwater at the subsites is used for drinking water purposes and lead is a contaminant of concern at OU-6. However, most residents of the subsites are served by rural water districts and the small number of households not supplied by rural water districts have not been found to have unacceptable water quality based on testing results.
- Clean Water Act (CWA) - The CWA, 33 U.S.C., requires states to establish surface water quality standards that are protective of human health and the environment. Many streams in the subsites are classified under the Kansas

standards, K.A.R. 28-16-28b et seq., and are subject to this criteria. The Kansas standards require that corrective actions be implemented to restore the designated uses of impaired surface waters as well as the return of original water conditions (K.A.R. 28-16-28(f)g). As part of this process, the state of Kansas has performed a Use Attainability Analysis (UAA) for certain stream segments at OU-6, and has developed Total Maximum Daily Loading (TMDL) limitations for certain OU-6 stream segments. The UAA and TMDL processes are relevant and appropriate requirements for this response action.

- MacDonald (2000) TEC or Background Sediment Criteria - Ecologically protective sediment criteria that are to be considered include the TEC values specified in MacDonald (2000). These criteria (Pb = 35.8 ppm, Cd = 0.99 ppm, and zinc (Zn) = 121 ppm), or alternative site-specific values to be developed in the future, constitute the recommended criteria for sediment removal based on ecological risks. The consensus-based TEC freshwater values represent the preferred set of critically evaluated values that have been demonstrated to accurately predict the absence of toxicity. The MacDonald criteria are contained in the following publication to be considered: MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater. Environmental Contaminants and Toxicology.
- Visual Presence of Surficial Mining Wastes - Historic analyses of mining wastes at the Cherokee County site, as well as from the larger Tri-State mining district, have shown elevated concentrations of heavy metals in mining wastes. This historic work has illustrated the commonality of wastes in the three state area and the commonality of hearth and environmental problems resulting from the presence of the wastes at the surface. The visual presence of surficial mining wastes is the criteria for removal under the selected remedy. This action is consistent with the approach to remediate surficial mining wastes at OU-3 and OU-5 of the Cherokee County site. These other operable unit response actions at the Cherokee County site are relevant and appropriate criteria for the current remedy at the nearby OU-6 subsites.

Location-specific ARARs establish restrictions on permissible concentrations of contaminants or establish criteria for conducting actions in sensitive locations such as flood plains, wetlands, streams, and areas of critical habitat. The location-specific ARARs are discussed below.

- Executive Order 11988, Protection of Flood Plains (40 CFR 6, Appendix A) - This is a legally applicable requirement for the response action given the presence of flood plains, especially the Spring River flood plain, at OU-6. The executive order requires that actions avoid adverse effects and minimize harm to flood

plains in addition to restoring and preserving the natural and beneficial values of flood plains to the extent possible. The OU-6 remedy is expected to comply with these requirements as the intent of the cleanup is to ultimately protect flood plains and streams by the removal of surficial mining wastes and impacted sediments.

- The Endangered Species Act (16 U.S.C., Section 1531, 50 CFR Part 200, 30 CRF Part 402, and the Kansas Non-game and Endangered Species Conservation Act, Kansas Statutes Annotated (KSA) 32-501) - These acts are legally applicable requirements due to the presence of several federal and state threatened and endangered species at the subsites. Threatened and endangered species, in addition to the habitat that supports these species, require protection and conservation. Moreover, consultation and coordination with the U.S. Fish and Wildlife Service and the state of Kansas will facilitate compliance with these requirements.
- Executive Order 11990, Protection of Wetlands (40 CFR 6, Appendix A) - This order is a legally applicable requirement due the presence of wetlands at OU-6 and it specifies the avoidance, to the extent practicable, of adverse impacts associated with the loss or destruction of wetlands resulting from response activities. The selected remedy is expected to comply with this requirement.
- The Fish and Wildlife Coordination Act (16 U.S.C., 40 CPR.) - This requirement protects fish and wildlife from actions that may affect habitat, such as the removal of sediments from streams, and as such, is a legally applicable requirement for the OU-6 remedy. Federal and state threatened and endangered species, in addition to critical habitat, are present at the OU-6 subsites. Coordination with the U.S. Fish and Wildlife Service of the U.S. Department of the Interior, in addition to the state of Kansas, will facilitate compliance with this requirement.
- The U.S. Department of the Interior's Preliminary Natural Resource Damage Assessment (NRDA), as Natural Resource Trustee for the Tri-State mining district, is to be considered for the OU-6 remedy. The EPA and the Trustee have different but complimentary roles. The EPA is responsible for the development of response actions to protect human health and the environment. The NRDA is used to identify additional actions, beyond the EPA response, to address natural resources, including restoration of habitats or species diversity, or compensation for the loss of injured natural resources. The EPA will coordinate with the Trustee so that the site work, to the extent practicable and consistent with the selected remedy, to the extent possible, will enhance restoration of habitats and species diversity.

- The National Historic Preservation Act (16 U.S.C.), and the regulation at 33 CFR Part 800 - These requirements are to be considered and specify that response actions consider historic properties eligible for, or included on, the National Register of Historic Places. Although unlikely, some historic mining properties or structures may be deemed eligible and appropriate for preservation. The subsites are part of the historic Tri-State mining district that operated for over 100 years and is nationally and internationally known as a major Pb-Zn field.
- The National Archeological and Historic Preservation Act (16 U.S.C., and 36 CFR Part 65) - These requirements are to be considered and specify the recovery and preservation of artifacts which may be discovered during implementation of response actions. Although unlikely, the OU-6 response action may uncover prehistoric, Native American, scientific, or archeological information subject to preservation.

The action-specific ARARs are based on activities and technologies to be implemented at the subsites. Examples include design, construction, and performance requirements related to conducting the response action. The action-specific ARARs are discussed below.

- The National Pollutant Discharge Elimination System, Effluent Limitations (40 CFR parts 122, 125, and 440) - The regulation at 40 CFR, Part 440 sets technology-based effluent limitations for mine drainage from mining related point sources. The OU-6 response action may temporarily generate effluent; thus, the above criteria are relevant and appropriate requirements for the implementation of the OU-6 remedy. However, the substantive requirements of these regulations are expected to be met through engineering controls during implementation of the remedy.
- The Surface Mining Control and Reclamation Act (30 U.S.C., 30 CFR Part 816, Sections 816.56, 816.97, 16.106, 816.111, 816.116, 816.133, and 816.150) - These relevant and appropriate requirements provide guidelines for the post-mining rehabilitation and reclamation of surface mines. These requirements are expected to be met by the implementation of the remedy. Coordination and consolidation with the U.S. Department of the Interior will assist in meeting these requirements.
- Kansas Regulations (K.A.R. 28-30-1) - These requirements for construction, re-construction, and plugging of water wells are legally applicable for the OU-6 remedy since the response action may involve the abandonment of deep water wells and boreholes acting as conduits to the lower aquifer.

- Clean Water Act (Section 404, 33 U.S.C., 40 CFR Part 230, and 231) - These relevant and appropriate requirements prohibit the discharge of dredged or fill materials into wetlands without a permit. The OU-6 remedy includes placing mining wastes in water-filled features (pits, ponds, and collapses); thus, the substantive aspects of these requirements are applicable and expected to be met by the implementation of the remedy. The intent of the cleanup is to remove highly eroding wastes from the surface and place these materials in water-filled features below ground in an effort to prevent surface contact by human and ecological receptors and surface erosion to streams while establishing anaerobic groundwater conditions that prohibit the migration of metals in the groundwater system.
- Rivers and Harbors Act (Section 10, 33 U.S.C.), and related regulations 33 CFR 320, and Section 404 of the CWA, 40 CFR, Part 125, subpart M - These relevant and appropriate requirements prohibit the disposal of dredge and fill materials into stream-s without a permit. The OU-6 remedy includes actions near (excavation, consolidation, and disposal of mining wastes) and in streams (sediment removal) and is expected to meet the substantive requirements of these criteria. The remedy does not include direct placement of material into streams but care must be taken while working near streams to ensure that materials do not wash into these features.
- Deed Restrictions and Institutional Controls (K.A.R. 28-30 and KSA, 82a-1036) - The state of Kansas and local governments may need to facilitate these controls as part of the long-term O&M components of the completed remedy in order to protect the integrity of the capped mine waste areas and establish controls on the use of groundwater for consumption. Potential restrictions would include prohibitions on future residential development in mine waste disposal areas and water well construction requirements or prohibitions pending future assessment of groundwater quality. The subsite areas are currently rural and used for agricultural purposes thus lessening the potential future need for deed restrictions and institutional controls restricting development activities.
- CWA Regulations on Storm Water Discharges from Industrial Activities - These regulations are applicable because surface mining wastes contribute metals loading to surface water bodies as a result of runoff generated from infiltration events and erosion by streams. The OU-6 remedy is expected to meet these criteria by reducing water pollution resulting from run-off. The remedy will ultimately remove surficial mine waste materials available for erosion and the implementation of the remedy will be controlled to address runoff or releases during construction.

Cost Effectiveness

The selected remedy, Alternative 4A estimated at 7 million dollars, is a cost-effective permanent solution to mining wastes impacting the Badger, Lawton, Waco, and Crestline subsites of the Cherokee County Superfund site. The remedy relies on conventional engineering methods that are easily implemented and since all surficial wastes and contaminated sediments are fully addressed, it is a permanent solution not subject to excessive future re-opening costs or other potential future costs associated with toxic tort lawsuits. Additionally, the response action will return the areas to a more natural condition that may prove beneficial from a natural resource perspective.

The selected remedy is less expensive than the FS alternative (> 10 million dollars for Alternative 6) that addressed all surficial wastes via source removal and above ground disposal. The selected remedy (4A) is more expensive than Alternatives 4 and 5 (each estimated at 5 million dollars); however, these alternatives do not address all surficial mining wastes, and as such, these remedies would be subject to re-opening provisions, future NRD claims and litigation, and potential toxic tort lawsuits, related to the un-remediated accumulations of mining wastes. Additionally, the mining wastes not subject to remediation would rely heavily on the institutional controls components of an existing ROD which have not been enacted to date. Conversely, Alternatives 4A and 6 rely on permanent engineering controls, and since Alternative 4A (7 million dollars) is a cost-effective solution as contrasted to Alternative 6 (> 10 million dollars), it is deemed the most cost-effective, permanent solution for the OU-6 subsites. Alternatives 1 (No-Action, 0.5 million dollars) and 2 (Water Management and Erosion Controls, 3 million dollars) are less expensive than Alternatives 4, 4A, 5, and 6; however, these two alternatives would not meet ARARs, would leave a large amount of un-remediated wastes with exacerbated problems discussed above, and are not considered optimally protective.

The selected remedy (Alternative 4A) will achieve all RAOs, meet all ARARs, require no ARARs waivers, and may provide substantial future monetary gain or benefit by providing toxic tort relief. The remedy will also provide more suitable habitats for natural resources. Alternative 4A is especially cost-effective in consideration of the benefits derived in relation to reducing or eliminating future environmental or legal claims under other statutes or laws.

Utilization of Permanent Solutions and Alternate Treatment Technologies

As discussed in the above section dealing with costs, Alternative 4A is a permanent solution that relies on typical engineering controls. However, the potential unknown aspect related to permanence is associated with the potential release of metals to groundwater resulting from subaqueous mine waste disposal. While the relatively new technology is expected to be promising, it is not applicable under certain hydrogeologic conditions. Coupled with the uncertainties stemming from the recently completed pilot study at the Waco subsite, there is a possibility of future groundwater impacts. However, the novel subaqueous mine waste disposal technology is considered an alternative treatment technology that may prove highly useful at

many future projects. The potential environmental gains resulting from this alternate technology, coupled with the complete surface protectiveness and the return of farm land to productive agricultural use, has factored into the EPA's decision to implement this technology on a remedial scale.

In summary, Alternative 4A has a high degree of permanence associated with the removal and capping of sediments and surficial mining wastes, and has a potentially lesser degree of permanence, subject to monitoring, of the groundwater component of the filled pits. Alternative 4A utilizes an alternative treatment technology that may prove highly beneficial at future sites. The controlled implementation of a remedial scale project is desirable.

Preference for Treatment

The preference for treatment is not satisfied by Alternative 4A with regard to actions at the Badger subsite and may not be satisfied for actions at the Lawton, Waco, and Crestline subsites, pending future monitoring. The mining wastes at the Badger subsite are located in the flood plain of the Spring River, a major main-stem interstate river, and are thus not appropriate for subaqueous mine waste disposal technology due to concerns regarding potential impacts to the upper groundwater system. Mining wastes at the Badger subsite will be excavated and disposed in conventional soil repositories outside the limits of the Spring River flood plain. The large volume of wastes, and the potentially expensive methods to stabilize or treat mining wastes, result in the preference for treatment not being met at this subsite due to technical infeasibility.

Subaqueous mine waste disposal methods at the Lawton, Waco, and Crestline subsites may satisfy the preference for treatment pending an analysis of groundwater conditions following disposal. The historic pilot study conducted at the Waco subsite has not demonstrated geochemical modifications that could be considered treatment to date; however, monitoring is continuing and the literature supports the possibility of achieving geochemical changes (anaerobic conditions) which could be considered a form of treatment. In summary, Alternative 4A may not be capable of satisfying the preference for treatment at three subsites and the treatment preference will not be met at one subsite.

Reduction of Mobility, Toxicity, and Volume

Alternative 4A will reduce the mobility and toxicity of the contaminants of concern; however, the volume of waste materials will not be reduced. Mining wastes and impacted sediments will be excavated, consolidated, disposed, and capped, thus decreasing the mobility and toxicity of the wastes. The volume of the waste materials will be unaffected by the selected alternative.

Five-Year Review Requirements

The selected remedy is subject to periodic five-year reviews in accordance with Section 121 (c) of CERCLA and the NCP. Although mining wastes will be removed from the surface, and thus eliminated from potential uptake by human and ecological receptors, the wastes will remain at the site at elevated levels below the surface. Potential groundwater impacts stemming from subaqueous mine waste disposal will require monitoring and assessment as part of the five-year review process. Moreover, the O&M requirements for integrity and monitoring of the capped areas will require assessment during the five-year review process in addition to the status of institutional controls that are woven throughout the county by a prior ROD.

DOCUMENTATION OF CHANGES

The following changes were made to the ROD in response to input received during the public comment period following the release of the Proposed Plan.

- In response to comments received from the KDHE, and supported by the U.S. Fish and Wildlife Service, the EPA has incorporated into the ROD the characterization of near shore sediments in water-filled pits, ponds, and collapse features that are not filled with mining wastes as part of the cleanup action. If sediments in these features exceed numeric or site-specific ecological criteria, they will be capped or covered to prevent risks to waterfowl.
- In response to comments received from the Empire Electric District Company, the ROD has incorporated the potential use of fly ash materials, in conjunction with soil, to cap mining wastes. Additional assessment of the viability and economy of the product will be necessary during the design phase of the project.
- In response to comments received from Highland Environmental and Environmental Management Services Company, the ROD has been modified to better explain the primary focus on ecological risks at OU-6 as contrasted to lesser potential concerns related to human health risks.
- In response to comments received from Highland Environmental, the ROD has been clarified by additional information supporting the decision to fully address the surficial mining wastes and sediments at the OU-6 subsites.
- In response to comments received from Phelps Dodge Corporation, the ROD has been clarified to indicate the EPA's willingness to accept site-specific sediment excavation criteria pending coordination with the EPA, the KDHE, and the U.S. Fish and Wildlife Service.

- Institutional controls to be implemented throughout the county, as described in the OU-3/4 ROD, have been incorporated.
- In an attempt to discuss integration of the NRD process and potential consideration for parties conducting CERCLA response actions at OU-6, the ROD has incorporated information on this natural resource topic.
- All known mine wastes at OU-6 are considered to be erodible to streams and subject to remediation. If additional surface wastes are found in the future and determined by the EPA to be non-erodible, site-specific cleanup standards to address both ecological and human health risks will be developed by the EPA in consultation with the KDHE and the U.S. Fish and Wildlife Services.

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1. Responsiveness Summary

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION

Badger, Lawton, Waco, and Crestline Subsites (OU-6)

Cherokee County Superfund Site

Cherokee County, Kansas

The responsiveness summary consists of the following three components: an overview of the public process; responses to verbal questions received at the public meeting; and responses to written correspondence received during the public comment period. This document is provided to accompany the Record of Decision and reflects input resulting from the Proposed Plan and public comment processes.

Overview

The Proposed Plan and supporting documents included in the Administrative Record were made available for public review and comment for 60 days from June 7 to August 6, 2004. The original 30-day comment period was scheduled to end on July 6, 2004; however, the period was extended an additional 30 days pursuant to a request by the responsible party group involved in historic work at the site. The responsible party group includes the following companies: E.I. du Pont de Nemours and Company (Dupont); NL Industries, Inc.; Phelps Dodge Corporation (formerly Cyprus Amax Minerals Company); and Sun Company, Inc. A public meeting was held in Columbus, Kansas, on June 22, 2004, with nearly 40 people in attendance. The transcript from the public meeting has been added to the Administrative Record.

A total of five letters were received during the 60-day public comment period from the following organizations: the Kansas Department of Health and Environment (KDHE); the Empire Electric District Company; Highland Environmental on behalf of NL Industries, Inc.; Phelps Dodge Corporation; and Environmental Management Services Company (EMS) on behalf of Dupont, NL Industries, Inc., and Sun Company, Inc. In general, the KDHE letter requested additional remedial enhancements to water bodies, the Empire letter requested consideration of the use of fly ash for cover materials, the Highland Environmental letter questioned the appropriateness of the proposed alternative and presumptive remedy process for the entire site, the Phelps Dodge Corporation letter questioned the cleanup criteria for the Crestline sub site, and the EMS letter questioned the proposed alternative for the Waco subsite. All letters received during the public comment period have been added to the Administrative Record.

Responses to Verbal Comments

Several verbal questions were asked at the public meeting following the formal presentation component of the meeting. The questions and associated responses are grouped for the individual posing the question. This summary provides generalized designations or affiliations for individuals asking questions. The detailed transcript of the public meeting has been added to the Administrative Record for the site.

Questions from a member of the Kansas House of Representatives - An elected state representative asked if the planned remedial actions in the Badger subsite would cause temporary detrimental impacts to the Spring River. The representative also asked if mining wastes at any of the subsites were currently being used for commercial purposes.

Responses to the State Representative's Questions - The proposed remedial action for the Badger subsite entails removal of mining wastes from the flood plain of the Spring River and does not include any active remediation work within the Spring River channel. The cleanup is not anticipated to have any short-term detrimental affects on the Spring River and will ultimately enhance water quality by alleviating the washing of mining wastes into the stream. There is no current commercial use of the surficial mining wastes in the Badger, Lawton, Waco, and Crestline subsites due to the rural setting of the wastes and the relatively small volumes that are present from a commercial standpoint.

Question from a Waco Subsite Land Owner - A local land owner asked if all of the open ponds, pits, and collapse features would be filled during the cleanup.

Response to the Land Owner - All of the surface water features will not be filled during the cleanup. Some water bodies are more desirable than others for filling with mining wastes based on water chemistry and hydraulic connections with the upper aquifer. Water bodies that are hydraulically isolated from the upper flow regime and exhibit anaerobic (low oxygen content) or high pH (not acidic) conditions are favored-over the converse. The favorable conditions help to restrict the release of heavy metals into the groundwater system while the unfavorable conditions may promote or enhance the release of metals into the water system.

Questions from a County Resident Employed by the Empire Electric District Company - A county resident employed by the Empire Electric District Company provided the following input: the individual expressed safety concerns related to haul truck traffic; inquired if the quality of water in the Spring River would be impacted by the cleanup in any manner that would affect the use of the water by the Empire Electric District; and recommended the use of fly ash materials from the nearby Riverton, Kansas, plant be used in conjunction with soil for capping mining wastes.

Responses to the County Resident - Haul routes will be coordinated with the Cherokee County Engineer and the roads will be monitored for safety aspects. Safety is a major consideration and always a component of environmental cleanups, especially the heavy truck hauling routes and practices. The water quality of Spring River will not be impacted by the cleanup and will not cause issues with surface water requirements for operation of the Empire Electric District Company. The use of fly ash will be considered for capping the mining wastes in conjunction with soil, but that is a detail of the design process and may not be cost-effective or technically adequate compared to soil only.

Question from an Employee of the Oklahoma Department of Environmental Quality - An Oklahoma Department of Environmental Quality (ODEQ) representative requested that the future work on the Spring River basin be addressed on a basin-wide scale as opposed to actions keyed on state boundaries or various jurisdictions of the Environmental Protection Agency (EPA).

Response to the ODEQ Representative - It was acknowledged that greater coordination is always a goal and effort in this regard will continue and be enhanced over time. The recent work by the U.S. Army Corps of Engineers in the development of basin-wide plans for the Spring River and Tar Creek watersheds were discussed as examples of recent coordination. The Spring River is present in Missouri, Kansas, and Oklahoma, spans two EPA regional office jurisdictions (the EPA, Region 6 for Oklahoma and the EPA, Region 7 for Missouri and Kansas), three U.S. Fish and Wildlife jurisdictions, and three state environmental agencies. The remaining work at the Cherokee County site includes an evaluation of the surficial non-residential mining wastes at the Treece subsite (OU-4) and the evaluation of the Spring River within Kansas (OU-2). These efforts will be coordinated with all involved parties.

Questions from a Joplin Globe Newspaper Reporter - A reporter from the Joplin Globe asked the following questions: how many residential yards and private wells were sampled at OU-6; are responsible parties expected to fund the proposed cleanup; and has the EPA been approached by local land owners stating that the mining wastes are considered to have value and represent a source of income.

Responses to the Joplin Globe Reporter - All known users of private wells were sampled and the results indicated that there are no impacted private wells and the residential sampling indicated that no properties require residential cleanups. Less than 60 residential properties were sampled and less than 10 private wells were tested at the OU-6 subsites. The subsites are rural with a small number of homes in proximity to mining wastes and most of the area is served by rural water districts. It is anticipated that responsible parties will fund a portion of the proposed cleanup and remaining areas will be funded by the EPA with support from the state of Kansas. The exact details regarding funding and liability will be assessed at a later date with responsible party involvement. The EPA has not been approached by any local land owners asserting that the mining wastes are valuable and constitute a source of income. No subsite wastes are being commercially utilized due to the rural, inaccessible nature of most of the wastes and the relatively small volumes that would be useable on a commercial scale.

Question from a Cherokee County Resident Engaged in Farming - A local farmer stated the desire for remediated lands to be returned to productive agricultural use if possible and asked if this would be possible following the cleanup.

Answer to the Local Farmer - Much land will be returned to agricultural use; however, the entire area of mining wastes will not be available for farming practices. The large accumulations of mining wastes will be greatly consolidated, capped, and many ponds, pits, and

collapse features filled with wastes. These actions will reduce the footprint of the mining wastes and return a sizeable amount of ground back to farming uses. The filled pits, shafts, and collapses, as well as capped areas of mining wastes, will not be desirable for farming. The ground may remain somewhat unstable after filling the pits, shafts, and collapse features, and as such, may present hazards related to continued settlement and collapsing after being filled and thus not be appropriate for farming. To ensure capped areas remain viable, those areas cannot be farmed. In sum, more land will be available for farming than is available now.

Question from a NewFields Environmental Contractor - A contractor representing some of the responsible parties asked a question regarding the extent of dredging or sediment removal at the subsites under the proposed alternative.

Response to the Contractor - The sediment removal activities will take place in drainage ways and streams that convey water from the areas of mine waste accumulations to receiving streams. Many, but not all, of these features are ephemeral and they do not include large intra-state main stem rivers such as the Spring River. The full extent of sediment removal actions will be determined during the pre-design or design phases pending the use of background or existing numeric standards for sediment removal.

Responses to Written Correspondence

KDHE Letter - The KDHE participated in the development of the Proposed Plan and provided written concurrence supporting the proposed cleanup plan prior to the public comment period. The KDHE submitted an additional comment during the public comment period requesting additional actions to cap or cover mining wastes in water-filled ponds, pits, or collapse features that remain on-site following the remedial action. This additional effort was requested in order to protect migratory birds from exposure to heavy metals while feeding on the near-shore bottom sediments of these surface water bodies.

Response to the KDHE Letter - The cleanup plan will be modified to include sampling of near bank sediments in mining ponds, pits, and collapse features not proposed for filling during the remedial action. If these areas exceed ecological based risk criteria, MacDonald (2000) threshold effects concentration (TEC) numeric values or background concentrations, some type of cover, such as soil or rip-rap, will be placed in these areas to provide protective cover for migratory birds. It should also be noted that this action may satisfy natural resource concerns of the U.S. Fish and Wildlife Service and result in a cover material that is protective of migratory birds.

Empire Electric District Company Letter - The Empire Electric District Company suggested the use of fly ash and bottom ash from their plant in Riverton, Kansas, for use in conjunction with soil to cap mine waste areas. The company further stated that the plant is in close proximity to the cleanup areas and the action would reduce landfill disposal of this product in Cherokee County. Toxicity Characteristic Leaching Potential (TCLP) analyses of the ash products were also provided as an attachment to the letter.

Response to the Empire Electric District Company Letter - The cleanup plan will be modified to potentially allow for the use of ash materials from the Empire plant for capping purposes in conjunction with soil. This action would result in the use of less soil, potentially result in cost savings related to the use of ash, and reduce the need to landfill the ash material in Cherokee County. Additional tests for other parameters will likely be required in order to more fully assess the viability of this product for use with soil to cap mining wastes. It should be noted that the U.S. Fish and Wildlife Service has historically recommended additional assessment of ash materials in order to more fully evaluate their suitability as capping materials. The remedial design phase will more fully explore the use of the product. The EPA appreciates the TCLP data and the offer of the ash materials for the cleanup. The materials will require a more detailed assessment of economic and technical viability during the design phase of the project.

Highland Environmental Letter - This letter on behalf of NL Industries, Inc. alleges that the proposed cleanup is inconsistent with the National Contingency Plan (NCP), deviates from the terms of an Administrative Order on Consent (AOC), does not follow the presumptive remedy process, and does not include various risk assessments. Additionally, the letter volunteers the performance of a risk assessment by NL Industries, Inc., states that the Administrative Record is deficient, and recommends that the cleanup not be conducted.

Response to the Highland Letter - The EPA believes the proposed cleanup is consistent with the NCP and feels the presumptive remedy process was followed under the AOC. The EPA will not require additional risk assessment work prior to remedy selection and implementation and believes the proposed cleanup is supported by the Administrative Record. The following bulleted items respond in greater detail to general themes or points contained in the Highland Environmental letter.

- AOC and Presumptive Remedy Process - Under the terms of the AOC (U.S. EPA Docket No. CERCLA-7-99-0002), the respondents (Cyprus Amax Minerals Company, Dupont, NL Industries, Inc., and Sun Company, Inc.) agreed to conduct a focused remedial investigation and presumptive remedy feasibility study (RI/FS) at OU-6 based on prior work conducted at the Baxter Springs and Treece subsites (OU-3/4) of the Cherokee County Superfund site in Cherokee County, Kansas. The RI did not require the performance of human health and ecological risk assessments, or extensive site characterization and chemical analytical sampling and analysis, due to the fact that many operable units of the Cherokee County site have been extensively sampled and risks have been characterized, although human health and ecological risks are continuing to be assessed on an ongoing basis by organizations inclusive of the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the Agency for Toxic Substances and Disease Registry, the EPA, and the KDHE. The completed RI was clearly focused and streamlined to support a presumptive remedy approach. It did not include extensive sampling, or the performance of risk assessments by intent, and was conducted in accordance with the AOC. Following completion of the RI, the FS was conducted and ultimately expanded beyond the limits of a presumptive remedy approach at the request of

the responsible parties; specifically, the request to include subaqueous mine waste disposal as a potential remedial alternative. This alternative was not a component of the historic Baxter Springs and Treece FS, and as such, has no basis for inclusion in a presumptive remedy FS based upon the FS for the Baxter Springs and Treece subsites. Additionally, this technology has no basis in any of the many completed remedial actions at various operable units and subsites within the Cherokee County site. The EPA did not initially agree to this presumptive remedy modification; however, after repeated requests by the responsible parties and following the performance of a preliminary subaqueous mine waste disposal pilot study conducted at the Waco subsite, the EPA, with concurrence of KDHE, agreed to allow the deviation to occur at the request of the responsible parties. As the FS process unfolded, the EPA requested an expansion of the FS to include more comprehensive cleanup approaches that were in accordance with approaches contained within the Baxter Springs and Treece FS. The respondents were offered an opportunity to terminate the AOC and not continue the FS process if they believed the suggested expansion of the document was beyond the bounds of the presumptive remedy process. Tables and text from the Baxter Springs and Treece FS were provided to the respondents during an FS meeting for assessment and decision-making purposes regarding completion of the FS document and further work under the AOC. The respondents voluntarily continued the FS process under the AOC. There are no proposed cleanup alternatives in the OU-6 FS that significantly differ from the Baxter Springs and Treece FS alternatives, with the exception of the subaqueous mine waste disposal components of various remedies which were sought by the responsible parties. In summary, the EPA believes that the AOC was appropriately conducted by the responsible parties and a focused RI and presumptive remedy FS resulted from the work.

- Risk Assessments and Administrative Record - Under the terms of the AOC, the EPA, by conscious intent, did not require the completion of human health or ecological risk assessments at this operable unit of the site. There is a wide body of site characterization and risk assessment data contained within the various Administrative Record files for the many cleanups that have been conducted at the several operable units and subsites of the Cherokee County Superfund site. These Administrative Records are incorporated into the Administrative Record for OU-6 (the Badger, Lawton, Waco, and Crestline subsites) by reference, and as such, constitute an adequate Administrative Record for the proposed remedy. As an illustration pertaining to a human health risk assessment issue raised in the Highland Environmental letter, the Integrated Exposure Uptake Biokinetic (IEUBK) model for lead in children was run for OU-7 (Galena Residential Soils) and the results were used to establish the residential criteria for the entire Cherokee County Superfund site due to the close proximity of the various operable units and subsites as well as the similarity of physical and contaminant conditions across the site. Accordingly, the EPA has made risk management decisions pertaining to the site as a whole and does not plan to repeatedly run the

IEUBK model or conduct multiple human health and ecological risk assessments for different areas of the same site that are in close geographic proximity to one another and exhibit similar waste characteristics. The Administrative Records pertaining to these various cleanups are incorporated by reference into the Administrative Record for OU-6 and are available for review in Cherokee County, Kansas, and at the EPA's office in Kansas City, Kansas. Specific Administrative Records in Cherokee County associated with past cleanups are available for review at the following locations: OU-3/4 (Baxter Springs and Treece subsites) at the Johnston Public Library in Baxter Springs, Kansas; OU-1 (Galena Alternate Water Supply), OU-5 (Galena Groundwater and Surface Water), and OU-7 (Galena Residential Soils) at the Galena Public Library in Galena, Kansas; and OU-6 (Badger, Lawton, Waco, and Crestline subsites) at the Columbus Public Library in Columbus, Kansas. With regard to remedy selection, the EPA has selected an alternative (4A) that specifies actions wholly contained within the final presumptive remedy FS report, and that report is contained within the Administrative Record file. Alternative 4A does not specify any cleanup actions that are not a component of the FS report and is thus not an arbitrary and capricious decision, but rather a decision based upon the record and consistent with the NCP.

- Selected Alternative 4A and the RI/FS Process - Alternative 4A was drafted by the EPA with support of the KDHE and the U.S. Fish and Wildlife Service as based on the range of alternatives provided in the presumptive remedy FS. Likewise, the selected alternative for the Baxter Springs and Treece subsites, Alternative 3b, was drafted by EPA with support of the KDHE and based on the range of alternatives provided within the OU-3/4 FS. The process of remedy selection for OU-6 is thus in accord with the process used for OU-3/4. The OU-6 proposed alternative (4A) specifies actions that are clearly components of the completed focused FS report. There are no actions, or any aspects of any actions, mandated by this remedy that are not included as possible remedy components in the focused FS report with the exception of the use numeric sediment criteria and assessment/potential mitigation of non-stream sediments. Furthermore, the proposed alternative has lesser requirements and is less costly than Alternative 6 in the focused FS report, and thus falls within a potential range of actions specified in the FS. The intent of the FS process is to arrive at a range of alternatives suitable for ultimate selection. The FS process does not recommend a specific alternative, but rather provides a range of potential alternatives that may be appropriate for the site. The range of alternatives may be modified by the selecting agency into a preferred alternative as is commonly the case. The EPA is the selecting agency, remedy selection is an inherently governmental function that is not performed by the responsible parties. The EPA coordinates remedy selection with the state (KDHE), as was the situation for the OU-6 remedy, as well as other federal agencies such as the U.S. Fish and Wildlife Service in this

example. The remedy selection process differs from the RI/FS process, since it is an agency function, and as such, the EPA, with support of the KDHE is responsible for developing the optimum cleanup approach. In general, selected alternatives may not always consist of one of the precise approaches discussed in an FS report.

- Cleanup Standards and Remedy Enhancements at OU-6 contrasted to OU-3/4 - The Highland Environmental letter questions the appropriateness of the proposed remedy for OU-6 as compared to OU-3/4 and references the lack of cleanup standards for non-residential mining wastes in OU-6 Alternative 4A. The selected alternative for OU-3/4 also did not include specific cleanup standards for non-residential mining wastes, the criteria was the visual presence of the wastes and this same criteria is utilized at OU-6 for non-residential mining wastes with the exception of sediments. New sediment criteria consisting of MacDonald (2000) TEC numeric values, or site-specific background values to be determined in the future if desired, are specified in the proposed alternative for OU-6 in lieu of visual standards. The EPA and the KDHE conducted sampling and analysis of sediments in the Lawton subsite and found appreciable concentrations of heavy metals (zinc values greater than 1,700 parts per million or ppm) in sediments that exhibited no visual indication of impact. The data and information are contained within the Administrative Record and illustrate the potential ecological issues associated with non-numeric criteria for sediments. Moreover, recent bird studies conducted by the U.S. Fish and Wildlife Service indicate potential mining sediment impacts to various bird species. The published studies are contained within the Administrative Record and the U.S. Fish and Wildlife Service, the KDHE, and the U.S. Geological Survey are in the process of planning and conducting additional more definitive bird studies in the Tri-State mining district, inclusive of the Cherokee County site. The numeric sediment criteria (MacDonald, 2000, TEC values) were recommended by the EPA, Region 7 ecological risk assessment staff, the KDHE, and the U.S. Fish and Wildlife Service. An additional remedy enhancement at OU-6 is the inclusion of all surficial mining wastes for remediation. This approach was also taken at OU-5 (Galena Groundwater and Surface Water) of the Cherokee County site and is thus fully consistent with a historically completed cleanup at the site but is more comprehensive than the historic approach at OU-3/4 (Baxter Springs and Treece subsites) of the Cherokee County site. The OU-4 cleanup is subject to re-opening provisions under the Consent Decree (Civil Action No. 99-1399-WEB) for this work and the effectiveness of the recently completed (2004) OU-3 cleanup is currently being studied and is thus at a premature stage for remedy assessment (the operation and maintenance plan is currently under final revision). A multi-year ecological study by the University of Kansas, Biological Survey, of the OU-5 remedy has shown ecological improvements, recently published bird studies indicate additional risks associated with mining impacted surficial and sediment

wastes, and recently completed use attainability analyses (UAAs) at OU-6 conducted under the total maximum daily load (TMDL) program, collectively illustrate the need to more fully address wastes at this operable unit. The Administrative Record contains UAA and TMDL information, many comments related to numeric sediment criteria, and information related to the desire for holistic, comprehensive remedies that are consistent with prior cleanups conducted at the site.

- Preference for Holistic Remedies that are Compatible with the U.S. Department of the Interior Natural Resource Damage (NRD) Actions and Other Statutes - The Highland Environmental letter requests additional clarifying information pertaining to the recommended cleanup at OU-6 and inquires about the viability of the past OU-3 cleanup. Under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the EPA has an obligation to work with natural resource trustees to ensure that Superfund remedies consider NRD criteria and are consistent with holistic environmental, solutions. Likewise, the EPA Superfund and Water programs (specifically the TMDL program in the OU-6 situation), as well as other environmental statutes and programs, are committed to holistic cross-statute environmental solutions that are protective of the environment on a drainage basin or watershed scale. Lastly, the state of Kansas as represented by KDHE, has a strong desire for future environmental remedies that are holistic. Thus, while the EPA has not determined that the Baxter Springs remedial action is deficient, the waiving of surface water criteria and the establishment of alternate toxicity reference values (TRVs) are not contemplated for future remedies at the Cherokee County site and were not contemplated for the OU-6 remedy as discussed during many early FS meetings conducted under the AOC. Several written comments contained in many letters within the Administrative Record discuss this point. The responsible party group was provided an opportunity to terminate the AOC following completion of the RI, but voluntarily chose to continue work on the FS in view of the EPA's consideration of approval of the inclusion of a non-presumptive remedy (subaqueous mine waste disposal technologies) in various alternatives. The NRD and TMDL programs were not fully engaged at the Cherokee County site during the remedy selection process for OU-3/4, this situation has clearly changed and is relevant to the OU-6 remedy. The historic OU-5 cleanup, which predated the OU-3/4 cleanup, provides a basis for addressing all surficial mining wastes, and since the remedy has been in place for a number of years it has also undergone an ecological assessment that cannot be performed in Baxter Springs at this time due to the recent completion of that work. As previously mentioned, the remedy selection process differs from the RI/FS process. The EPA has, with the support of the KDHE and the U.S. Fish and Wildlife Service, considered the holistic nature of environmental protection in the proposed alternative for OU-6, and that alternative is contained within the presumptive remedy FS for the site.

- Residential versus non-Residential Cleanups - The Highland Environmental letter references the Superfund Lead-Contaminated Residential Sites Handbook as justification to not remediate rural mining impacted lands. This handbook is applicable to residential cleanups but is not appropriate guidance for ecological mine waste cleanups that are typically focused on remote, undeveloped, lead-contaminated land. The major concern with rural mining waste accumulations at OU-6 does not entail real estate development in these areas but is predominantly the ecological risks associated with surficial accumulations of mining wastes and the possibility of this material being utilized in residential applications as fill or landscape materials. New construction and trespassing are considered lesser threats, the EPA has made changes to the Record of Decision to better discuss the human health risks in response to input provided in the Highland Environmental letter. The high levels of zinc are the primary risk drivers for ecological receptors. The EPA is not contemplating significant residential development in the area but is rather more concerned with the ecological risks resulting from the high zinc levels in the surficial mining wastes. The Waco subdistrict is noted for its high zinc production and the mining wastes in this area are more enriched with zinc, as opposed to lead, and represent some of the more concentrated zinc wastes within the Tri-State mining district. As an example, fish tissue samples from the OU-6 subsites contain higher levels of zinc than similar samples analyzed at the OU-3/4 subsites in Kansas and the Jasper County site in Missouri. Human health risks may be deemed to be of less potential importance than ecological risks at OU-6 and basically include the use of mine waste materials in residential settings, outdoor activities in mine waste areas, and possible residential development. The EPA acknowledges that outdoor activities and residential development are not highly probable (modifications made in the Summary of Site Risks portion of the Record of Decision and information added to the Current and Potential Future Land Use and Resource Uses section) but the future potential human health risk does exist in combination with ecological risks.
- Validity of Selected Alternative 4A - Alternative 4A is a modification of Alternative 4 which is contained within the FS report. Alternative 4A is exactly the same as Alternative 4 with regard to cleanup actions at the Badger, Lawton, and Crestline subsites but differs from Alternative 4 at the Waco subsite by requiring all surficial wastes to be addressed (essentially 100 additional acres from the Alternative 4 criteria). Alternative 6 of the final FS report also requires all surficial wastes to be addressed at the Waco subsite in addition to sophisticated engineered cap designs and a preference for capping as opposed to subaqueous mine waste disposal. Alternative 6 does not allow subaqueous mine waste disposal at any other subsites (Badger, Lawton, and Crestline) and only allows a limited amount for the Waco subsite. All active remedies preclude subaqueous mine waste disposal at the Badger subsite due to the close proximity of the Spring

River. Alternative 4A does not include any actions not prescribed by the FS report, with the exception of numeric sediment criteria and potential non-stream sediment mitigating, and in fact specifies the exact same actions as Alternative 4 for the Badger, Lawton, and Crestline subsites, thus the nomenclature for this alternative was correctly designated as 4A, a modification of Alternative 4. Alternative 6 precludes subaqueous mine waste disposal in all areas with the exception of a limited amount in the Waco subsite, specifies a full areal mine waste cleanup in Waco, and utilizes sophisticated, engineered cap designs. The selected alternative (4A) resulted from the presumptive remedy FS, with minor exceptions, and the FS is contained within and supported by the Administrative Record for the site.

Phelps Dodge Corporation Letter - The Phelps Dodge Corporation letter is specific to the Crestline subsite and questions the use of numeric sediment criteria, describes subsite streams as having poor quality habitat, and mentions other potential contributors to the environmental problems observed at the site. The letter also offers to conduct additional sampling activities and indicates the belief that aquatic life at the subsites has not been adversely impacted. Lastly, the letter mentions potential allocation assessments for cleanup actions under the proposed alternative.

Response to the Phelps Dodge Corporation Letter - Many of the points have been addressed by the above responses to the Highland Environmental letter. The following bulleted items respond more fully to the concerns raised in the Phelps Dodge Corporation letter and are grouped by subject area for ease of interpretation.

- **Numeric Sediment Criteria** - It is acceptable to the EPA to determine site-specific background sediment criteria in lieu of MacDonald (2000) TEC criteria if desired. Any new proposed criteria will be subject to coordination with the EPA, the KDHE, and the U.S. Fish and Wildlife Service. As mentioned previously in the Highland Environmental response, the numeric sediment criteria were recommended by internal EPA, Region 7 ecological risk assessment staff, ecological risk professionals from the KDHE, and the U.S. Fish and Wildlife Service. Additional information discussing the rationale for numeric based values as opposed to visual methods is contained in earlier responses - historic sampling has shown elevated levels of contaminants in sediments that did not appear to be visually impacted. The EPA believes that numeric sediment criteria are necessary as opposed to visual methods and is willing to consider alternate proposed criteria during the remedial design or remedial action phases. A design investigation study may be the appropriate time frame for such a determination if desired.
- **Quality of Habitat at the Subsite** - The quality of the habitat in the Crestline subsite is higher than illustrated by the Phelps Dodge Corporation letter as based on information contained within the Administrative Record inclusive of the

results of the UAAs that were conducted by KDHE. These field-based UAA studies assessed the habitat in many of the OU-6 subsite streams and the findings included the support of a diverse and vital ecosystem in many instances. Review comments from the KDHE on the RI reports also contain much information regarding habitat characteristics at OU-6. As an example, RI comments from KDHE (December 22, 1999, letter from Mr. Leo Henning) indicate that the Spring River near the Crestline subsite has habitat development index (HDI) scores that are among the highest ever recorded in Kansas and the river is designated in the Kansas surface water quality standards as a special aquatic life use water and an exceptional state water. In addition to some of the highest HDI scores ever recorded in Kansas, the Kansas Department of Wildlife and Parks has designated the Spring River as critical habitat for five threatened and endangered (T/E) fish species, six T/E mussel species, and has classified the river as a highest-valued fishery resource. Additionally, the National Park Service has classified the Spring River as an outstanding, remarkable stream for fishing, recreational, scenic, and wildlife attributes. In summary, the Spring River and associated water bodies are considered valuable and precious surface water resources. The Administrative Record contains UAA and TMDL information in addition to the KDHE comments related to habitat quality.

- Other Potential Contributors to Environmental Degradation - The EPA acknowledges the contribution of other sources of contamination as mentioned in the Phelps Dodge Corporation letter; however, we continue to believe that the most significant heavy metal impacts to the ecosystem are a result of past lead-zinc mining in the Tri-State mining district. The lead-zinc mining impacts to the environment have been well established through a multitude of scientific and engineering studies conducted in all three states (Kansas, Missouri, and Oklahoma) comprising the former Tri-State mining district by a large number of diverse organizations.
- Allocation Assessments - The EPA appreciates the early discussion of liability in preparation for future cleanup negotiations with responsible parties, but this information is not relevant to the selection of the appropriate remedy for the OU.

EMS Letter - The EMS letter recommends that the proposed alternative be Withdrawn in favor of Alternative 4, questions the nomenclature and NCP support for the proposed alternative (4A), and states concerns related to the EPA's ability to fund the cleanup. The letter includes an attachment from NewFields, on behalf of EMS, with supporting information on the same general topics.

Responses to the EMS Letter - The EPA has selected Alternative 4A as embodied in the accompanying Record of Decision for OU-6 and believes that this approach is appropriately named and optimally meets NCP criteria. The EPA's ability to fund cleanups is not a relevant topic for discussion. The following bulleted items, in addition to earlier responses to other letters, address the major points contained within the EMS letter and attachment.

- Selection and Designation of Alternative 4A - The EMS letter indicates that a specific remedy, namely Alternative 4, was recommended in the FS and further states that Alternative 4 substantially differs from Alternative 4A and is essentially Alternative 6. In actuality, the FS does not recommend a specific alternative, but rather provides a potential range of alternatives from which the selecting agency (the EPA) may choose, or modify, as necessary. The EMS letter incorrectly implies that a certain “remedy” was recommended in the FS process. The goal of the FS process is expressly to not recommend a specific approach but rather to provide a range of potential options for consideration by the selecting agency. The work required by Alternative 4A clearly fits within the range of possible FS options, this point is also discussed in earlier comment responses. Prior responses to other letters also elaborate on the distinctions and goals of the FS process as contrasted to the remedy selection process, the relationship between the FS process and remedy selection, and the authority and goals of remedy selection. With regard to the designation or naming of Alternative 4A, this remedy requires identical remedial actions at the Badger, Lawton, and Crestline subsites as Alternative 4 and only differs from Alternative 4 at the Waco subsite by the inclusion of approximately an additional 100 acres of mining wastes to be addressed. Alternative 4A is thus correctly named, as it is identical to Alternative 4 in every respect with the exception of an increase in the area of wastes to be addressed at the Waco subsite. In contrast, Alternative 6 requires different actions than Alternative 4 at three subsites (the Lawton, Waco, and Crestline subsites). All active remedies preclude subaqueous mine waste disposal at the Badger subsite. Alternative 6 prohibits the use of subaqueous mine waste disposal at the Lawton and Crestline subsites, minimizes the amount of subaqueous mine waste disposal to the extent practicable at the Waco subsite, and favors the use of highly sophisticated, engineered caps at all subsites. Alternative 6 is also much more costly than Alternatives 4 and 4A, and thus is clearly a different remedial approach, especially considering the required preclusion of subaqueous mine disposal methods.
- NCP Support for the Proposed Alternative - The EMS letter indicates that the contaminants of concern at OU-6 are generally lower in concentration than those found at OU-3/4. While lead values may be lower as based on a relatively small amount of sample data, zinc values are in fact much higher at OU-6 than OU-3/4 and represent some of the most elevated zinc values observed within the 2,500 mile span of the Tri-State mining district. As discussed in a prior comment response, fish tissue samples from OU-6 contained higher levels of zinc than were observed in similar samples from Jasper County, Missouri and other Cherokee County, Kansas, subsites. The Waco area was especially noted for its zinc reserves during periods of active mining. Since zinc is the primary driver of ecological risks, these elevated levels present additional concerns related to ecological risks, especially in light of the recently released zinc toxicity bird studies and NRD claims for the Cherokee County site. The EPA and the KDHE

provided review comments on past draft reports discussing the elevated nature of zinc data at OU-6 as contrasted to OU-3/4 and this information, as well as relevant bird zinc toxicity studies, are contained within the Administrative Record for the site. The EMS letter repeatedly indicates that a certain remedy was mandated by the AOC and discusses certain future remedial action funding agreements made by the EPA in exchange for the respondent's agreement to consider a subaqueous mine waste disposal approach. The EPA has made no such funding commitments for future remedial allocations as part of the AOC process and only agreed to consider subaqueous mine waste disposal remedial alternatives at the request of the respondents. The Administrative Record clearly contains EPA's initial comments refusing the respondent's proposals for a subaqueous mine waste disposal approach. The EMS letter misrepresents the AOC process and agreements that were reached during that time frame. As previously discussed, remedy selection is an EPA function that is separate from the AOC process. Moreover, the EMS letter states that the EPA and the KDHE do not believe that Alternative 6 is more protective than Alternative 4; however, the Administrative Record includes many comments by the EPA and the KDHE that clearly indicate a higher level of protectiveness, in our collective view, associated with remedies that employ more stringent criteria.

- Site Risks and Remedy Effectiveness - The EMS letter states that human health risks do not exist at OU-6 and that a range of remedies, Alternatives 2 through 6, provide equal protection, and as such, the least expensive remedy should be selected. The EPA, the KDHE, and the U.S. Fish and Wildlife Service do not believe that the range of potential alternatives (2 - 6) offer equal protection of the environment. Given the large differences of mine waste materials addressed by the range of remedies, and the fact that mine wastes are hazardous, the removal of greater volumes of mining wastes provides greater protection of the environment and is in concert with NRD goals and criteria. The EMS letter indicates that the OU-3/4 Ecological Risk Assessment determined that the potential risks to terrestrial receptors were determined to be "low" and adequately addressed by the OU-3/4 remedy which included the use of TRVs in lieu of state standards (waivers required). In fact, the OU-3/4 Ecological Risk Assessment determined that risks were unacceptable (toxicity quotients > 10 in some instances, a value greater than 1 indicates unacceptable risk), state water quality standards were waived, and TRVs for lead, cadmium, and zinc were established at levels equivalent to lethality in 50% of the affected population (concentration values known as an LC50, lethal to the species in question approximately 50% of the time). Since Alternative 2 is a similar remedy to the OU-3/4 approach, and water standards are not contemplated to be waived and TRVs will not be established, the EPA does not believe that Alternative 2 would offer the same degree of protectiveness as the total mine waste removal approach (Alternative 6). Likewise, successive remedies that remove greater volumes of wastes will result in greater protectiveness. In regard to human health risks, the EPA agrees that

human health risks are not as severe as ecological risks and did include a discussion indicating that residential properties do not require remediation and groundwater supplies currently known to be utilized are not impacted. Although the potential for development is low, there is a potential for such action as well as the potential for use of the surficial wastes in residential applications since the areas are not secured. The high zinc levels and ecological impacts are the primary risk drivers for the OU-6 cleanup. The EPA has added clarifying language on this point in the Record of Decision (Summary of Site Risks and Current and Potential Future Land Use and Resource Uses Section) in response to input in the EMS and Highland Environmental letters.

- Release of draft Natural Resource Damage Assessment (NRDA) Report - The draft NRDA for the Cherokee County site was released for public review during the period of August 13 to September 13, 2004, and has been incorporated into the Administrative Record file for OU-6. The Trustees (the U.S. Fish and Wildlife Service and the state of Kansas, KDHE) are currently developing a responsiveness summary for the comments received. This NRD assessment provides further support for the increase in ecosystem protectiveness as a result of addressing a greater extent of mining wastes.
- Release of Tar Creek and Lower Spring River Watershed Management Plan by the U.S. Army Corps of Engineers - A reconnaissance phase, draft plan for addressing mining impacts within the Spring River and Tar Creek drainage basins has been released by the U.S. Army Corps of Engineers as a multi-agency effort (U.S. EPA, U.S. Army Corps of Engineers, U.S. Department of the Interior) aimed at addressing mining wastes remaining in the Tri-State mining district. This effort and plan continue to support the need to address all surficial wastes within the district. This plan does not recommend that wastes remain in place, the ultimate goal is the removal or remediation of all mining wastes and sediments within the former mining district. The plan recommends the initial removal or remediation of all mining wastes within 100-year flood plains and all impacted sediments followed by removal or remediation of all mining wastes within the Tri-State mining district. The plan emphasizes a “holistic” response to address the myriad environmental issues within the former mining district and discusses the need for comprehensive solutions that ultimately address all sediments and surficial mining wastes. National Environmental Policy Act (NEPA) strategy for the entire Tri-State mining district is discussed in the plan in addition to natural resource issues. Natural resource and NEPA strategies cover all three states (Missouri, Oklahoma, and Kansas) and acknowledge downstream impacts and re-contamination issues for Oklahoma as a result of actions in Kansas and Missouri and for Kansas and Oklahoma with regard to impacts from Missouri. Moreover, the plan discusses the upstream environmental impacts from Kansas and Missouri that threaten tribal lands in downstream portions of Oklahoma. The Spring River receives mining impacts from wastes within Missouri and Kansas and these

impacts ultimately accumulate in the Grand Lake O' the Cherokees in Oklahoma, the final receiving water body. Similarly, Tar Creek is impacted by upstream mining wastes in Kansas prior to flowing south to Oklahoma where additional impacts are added prior to discharge to the Neosho River and then to the Grand Lake O' the Cherokees. Surficial mining wastes and sediments in the upstream states of Missouri and Kansas are specifically identified as issues for downstream tribal and state lands in Oklahoma and include many receiving bodies such as the Spring River, Tar Creek, Lytle Creek, Neosho River, and Grand Lake O' the Cherokees, all within the state of Oklahoma. The recommended actions resulting from the multi-agency watershed management plan for the Tri-State mining district support the EPA, Region 7 decision to implement a comprehensive holistic approach at OU-6. The U.S. Army Corps of Engineers draft watershed management plan for the Tri-State mining district has been added to the Administrative Record.

- Historic Mine Waste Cleanup at OU-5 (Galena subsite) of the Cherokee County site - The EPA historically remediated (1995 completion) all surficial mining wastes at the Galena subsite (900 total acres) within the Cherokee County Superfund site. This past cleanup also provides a foundation for comprehensive remedies that address all surficial accumulations of mining wastes at the Cherokee County site. Subsequent ecological studies (University of Kansas, Kansas Biological Survey) have indicated environmental gains resulting from this cleanup. The EPA believes there is much foundation and basis for selecting comprehensive cleanup approaches and notes that the selected alternative for OU-6 includes actions specified within the FS for the site.
- Toxic Tort Lawsuits and Ongoing Human Health Risks - The EPA notes the recent announcement (July 2004) of additional multi-million dollar lawsuits directed toward responsible parties for environmental harm to children as a result of former mining operations in the Tri-State mining district. Many prior lawsuits, as well as the current round of future litigation, again illustrate the ongoing human health issues associated with surficial mining wastes in the Tri-State mining district. The EPA believes that these actions further support the need to address all surficial mining wastes at the Cherokee County site and also illustrate the views of the general public regarding mining wastes and the environment. Current and historic toxic tort information has been added to the Administrative Record in a September 2004, addendum. All additions to the Administrative Record are contained within this addendum that further supports the ROD for OU-6.
- Permanence, Reliability, and Costs of Alternative 4 - The EMS letter indicates that Alternative 4 is the preferred approach due to its superior permanence and reliability factors in combination with its low costs as contrasted to twice the cost for implementation of Alternative 4A. The EPA does not consider subaqueous

mine waste disposal technology to represent the most effective remedy in terms of performance and reliability. The remedy was selected in order to implement a more controlled remedial scale cleanup approach that will hopefully provide data and information that were lacking as a result of the inconclusive pilot study performed at the Waco subsite. The pilot study failed to establish the hydraulic connection and monitoring effectiveness of monitoring wells assessing contamination emanating from the filled pit, failed to determine groundwater flow directions and gradients (both horizontal and vertical), and included a dye trace study that was inconclusive and ultimately not published or placed within the report. Several review comments from the EPA and the KDHE illustrating these points are contained within the Administrative Record. The study did show substantial increases in metals concentrations within the filled pit (greater than ten-fold) that have been decreasing over time; although, the contaminant concentration levels have not decreased to pre-pit filling concentrations and there are no geochemical data that support any type of chemical neutralization (anaerobic condition) is occurring and the hydraulic controls and monitoring points surrounding the filled pit have not been proven to be capable of effectively monitoring any impacts from the filled pit. The EPA provided sampling and analysis results to Newfields (electronic mail on 11/4/03 and 11/20/03) demonstrating the lack of geochemical data substantiating the achievement of reducing, anaerobic conditions based on samples analyzed by the EPA from the Waco pilot study pit. This information has been added to the Administrative Record. In summary, the pilot test has not been conclusive in answering questions on the viability of subaqueous mine waste disposal, and given the fact that this is a new technology with an unproven historic record, the EPA does not consider this approach to represent the best choice in terms of permanence and reliability, but nonetheless, has decided, with KDHE and U.S. Fish and Wildlife Service concurrence, to implement this technology as a remedial demonstration aimed at additional data gathering and process validation. With regard to costs, Alternative 4 is estimated at an approximate cost of 5 million dollars and Alternative 4A is estimated at an approximate cost of 7 million dollars.

- Modifying Criteria Evaluation - The EMS letter indicates that conversations with local land owners (four total identified earlier for the Waco area) indicate that a no action alternative is preferred and that there are concerns over takings issues related to remediation of mining wastes. The EPA has also had conversations with two of the Waco landowners, as well as additional landowners in the Crestline and Badger subsites, and has not been informed by any land owner that a no action alternative is preferred and has also not been informed of any concerns related to mine waste takings issues. Additionally, no documents to this effect were made by landowners at the public meeting or in writing (although the EPA notes that land owners were not required to attend the meeting or make comments). However, speaking to the point of community acceptance, it should be noted that there is no

active removal or sale of mining wastes from any of the remote OU-6 subsites. Moreover, the EPA has had conversations with many residents (several hundred people) of Cherokee County, Kansas, during past environmental work conducted at the site and has experienced wide-spread citizen support for removal and remediation of mining wastes within the county. Mayors and city council members from the communities of Baxter Springs, Treece, and Galena, Kansas have all indicated strong support for environmental cleanups in Cherokee County. Similar support has been provided by the Cherokee County Commissioners (recent decision to terminate the use of chat mining wastes for surface road material), the Cherokee County Health Department, and the Cherokee County Engineer. Additional work beyond the amount performed under all of the historic cleanup decisions has been requested by all municipalities involved in all historic cleanups. Private citizen lawsuits referenced in the toxic tort discussion above also illustrate the wide-spread concern and opinions of citizens within the Tri-State mining district on the topic of mining wastes and environmental impacts.

- Cleanup Funding and Responsible Party Liability Assessment - The EMS letter raises questions and issues related to the Federal Government's ability to fund environmental cleanups and discusses potential future liability assessments for responsible parties. This discussion is not relevant to the proposed selection of the remedy, and is better suited for future Consent Decree discussions for performance of remedial design and remedial action at OU-6.

Figure 1

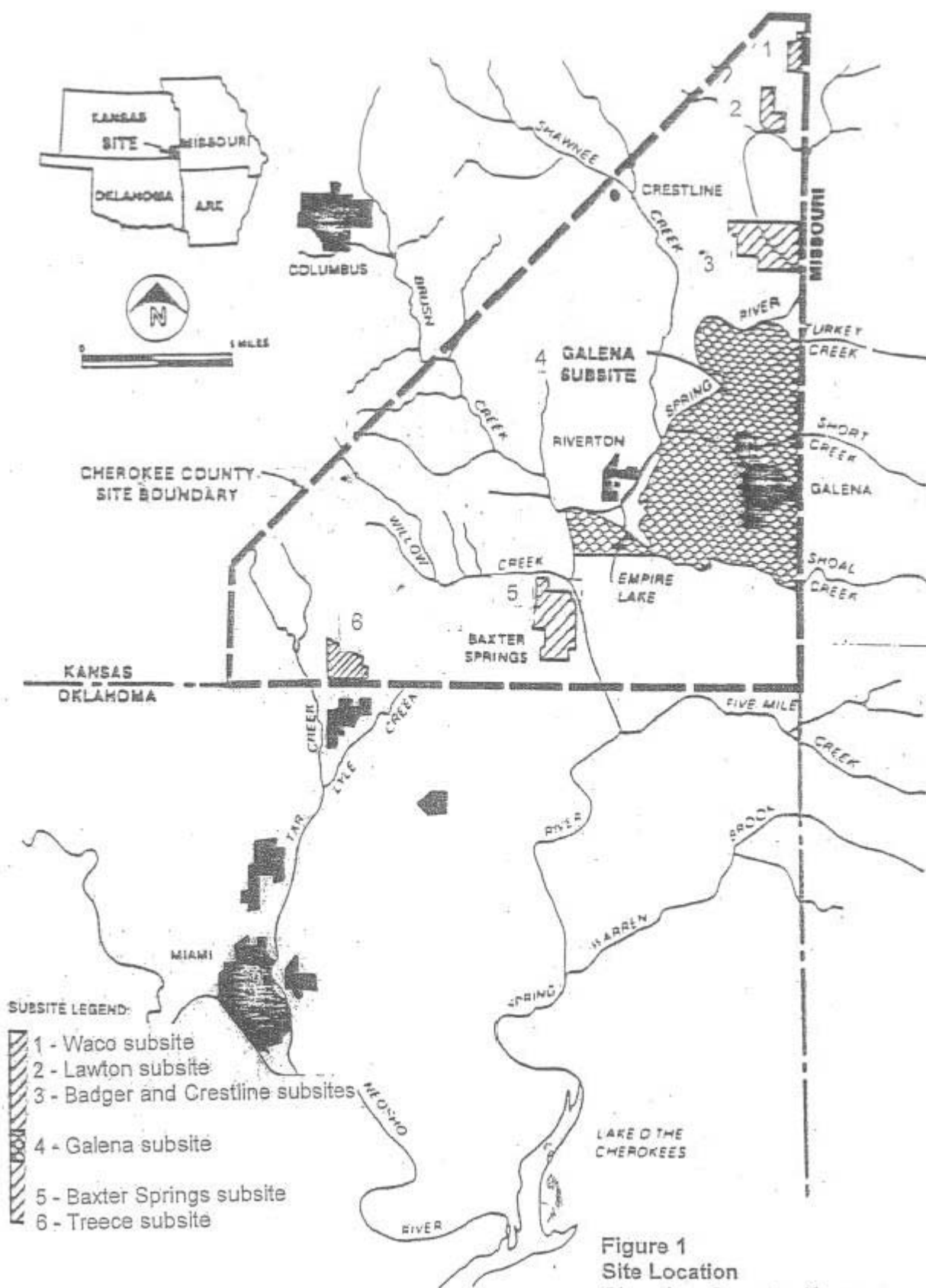
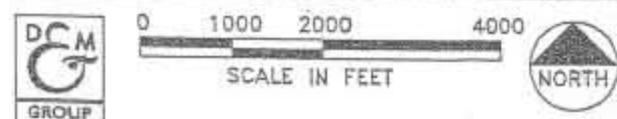
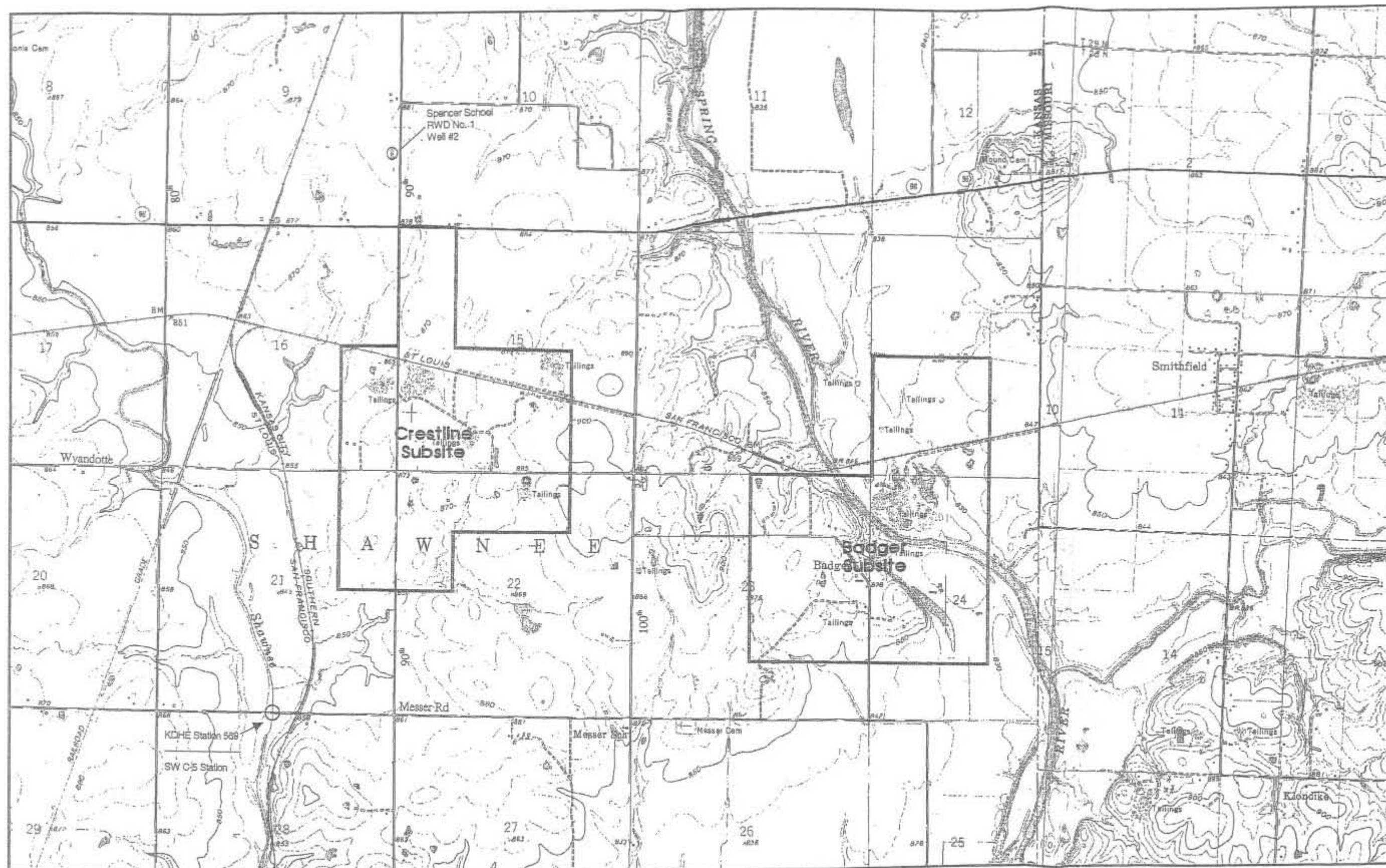


Figure 1
Site Location
Cherokee County, Kansas



CHEROKEE COUNTY KANSAS
Crestline & Badger
Subsite Location Map
Figure 2

Figure 2

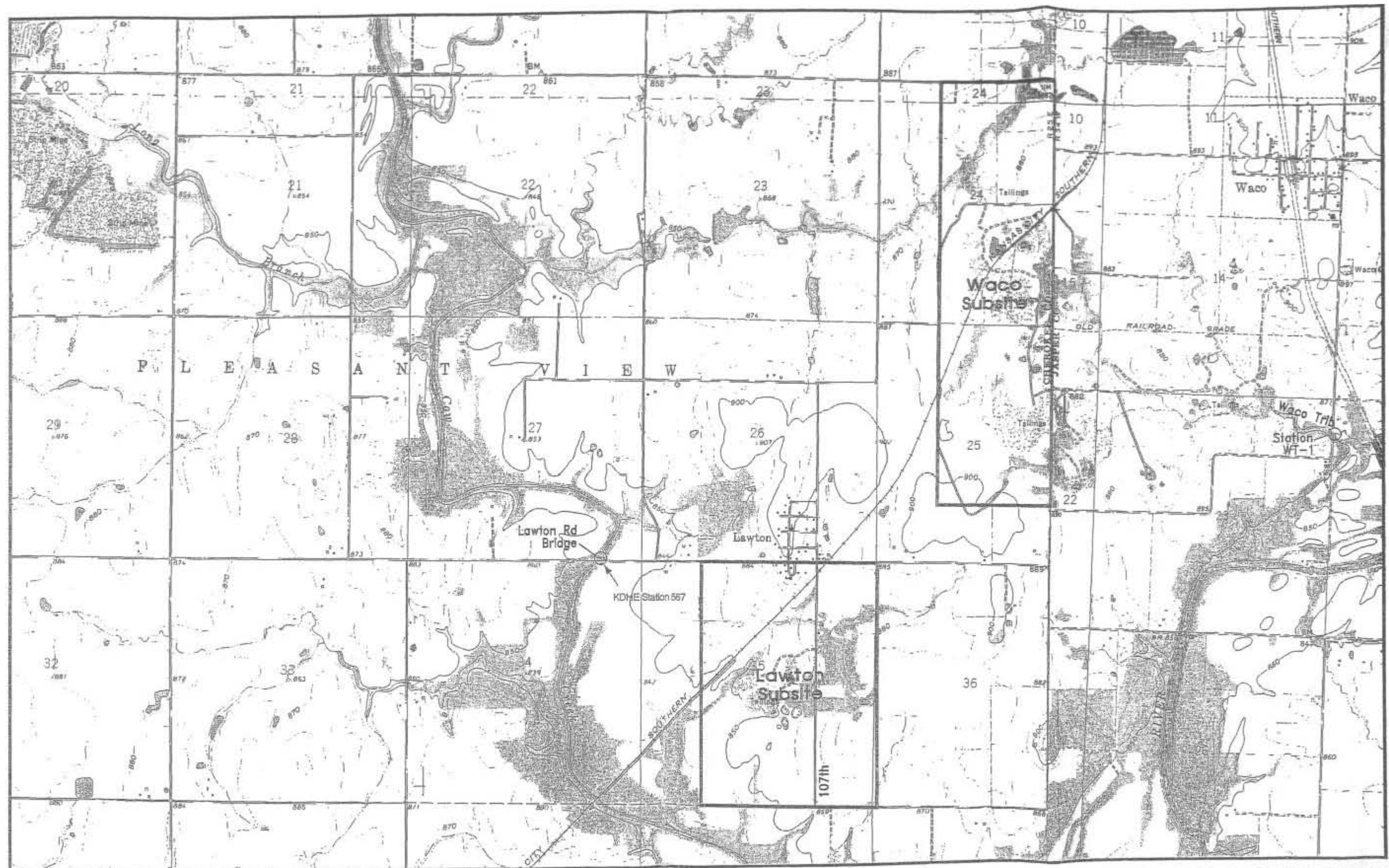
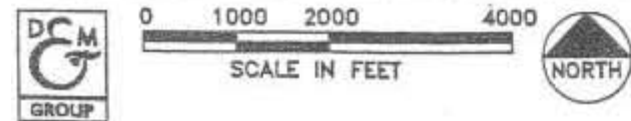
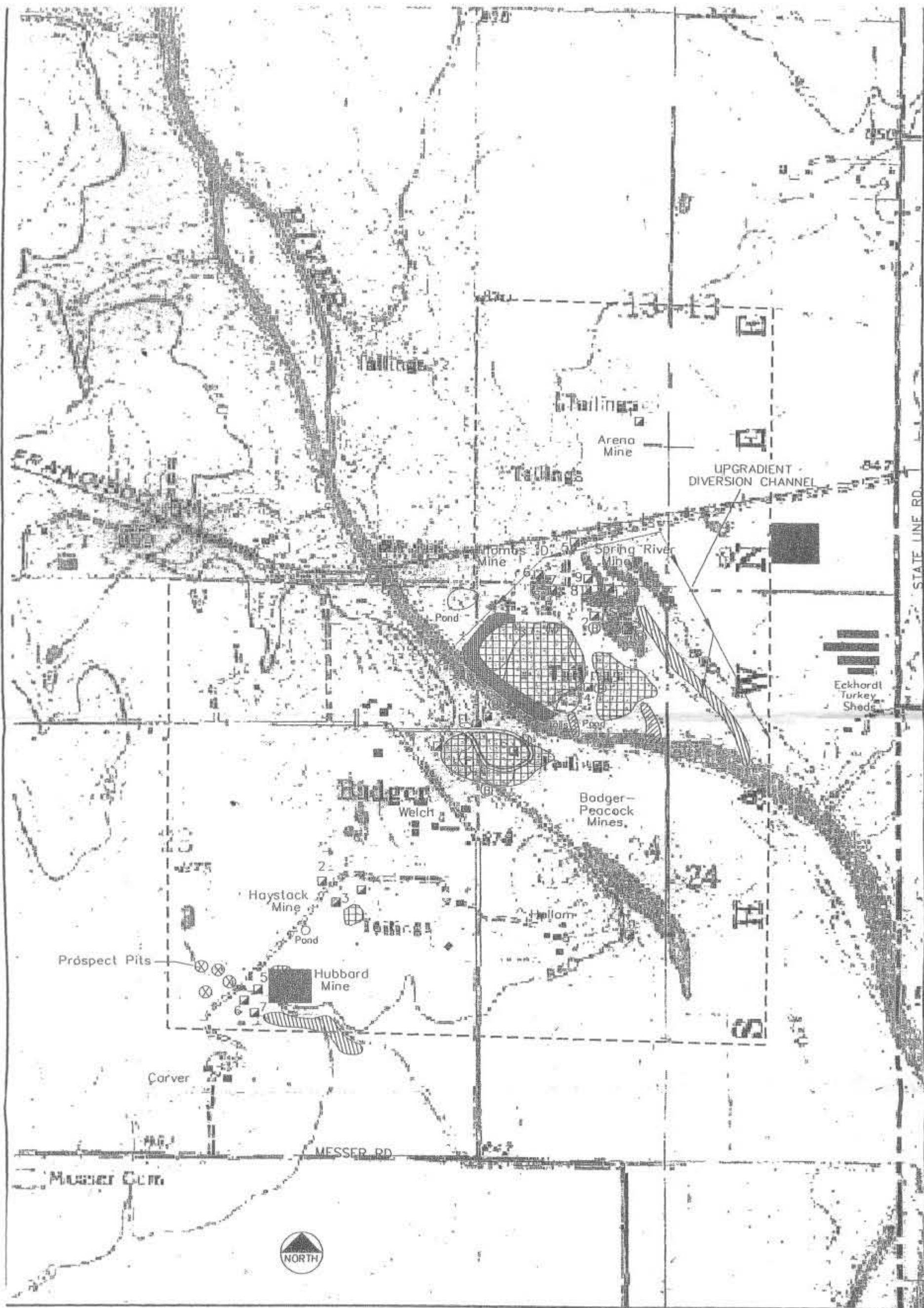


Figure 3

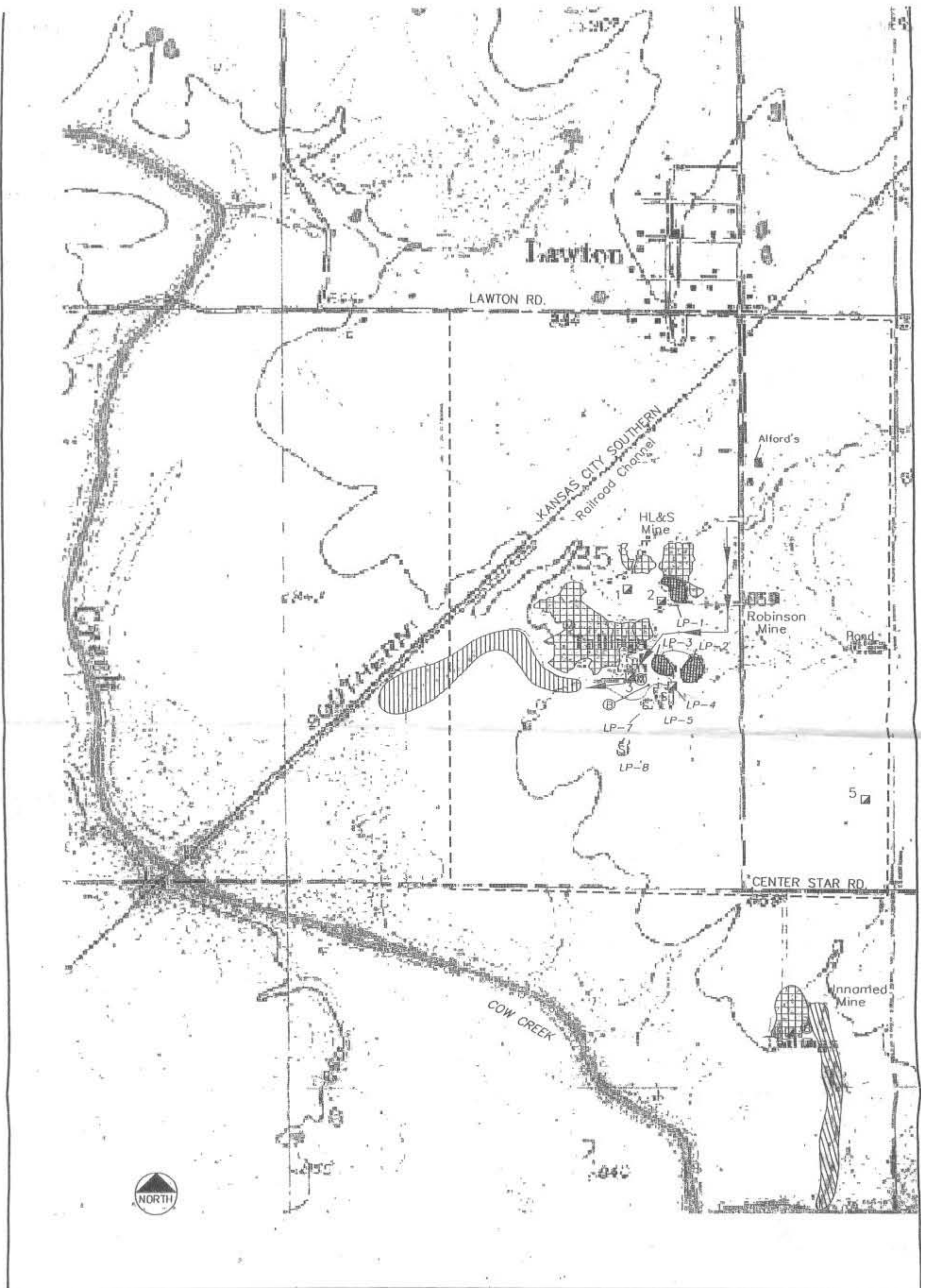


CHEROKEE COUNTY KANSAS
Lawton & Waco
Subsite Location Map
Figure 3



CHEROKEE COUNTY KANSAS
Badger Subsite
Alternatives 4, 5, & 6

Figure 4



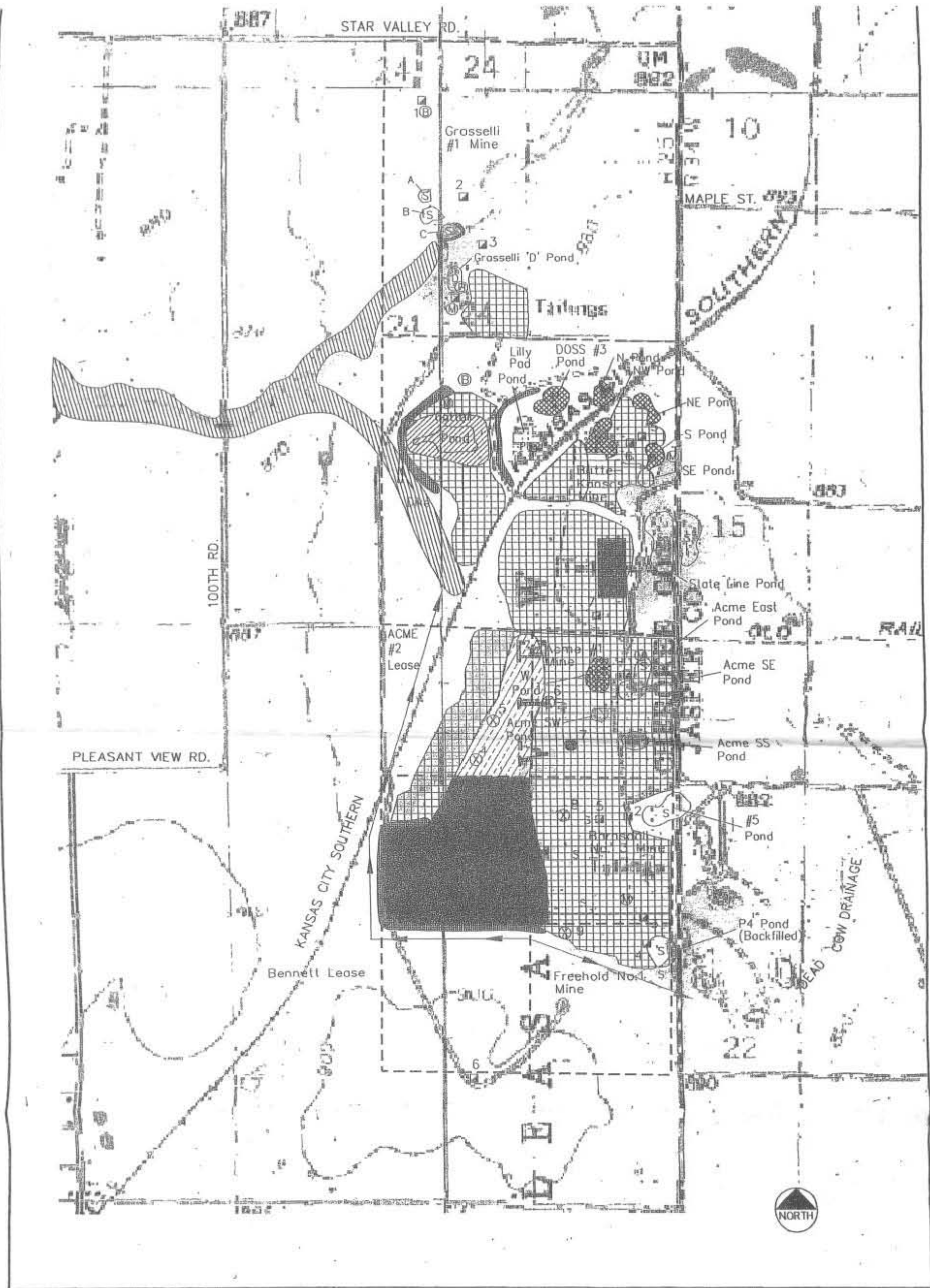
LEGEND

- | | | |
|-------------|---------------------|------------------------------------|
| ⊙ BULLROCK | S SUBSIDENCE PIT | ▨ EXCAVATED STREAM CHANNEL |
| Ⓜ MILL SITE | □ MILL WASTE | ▨ EXCAVATED MILL WASTE |
| ▣ SHAFT | → DIVERSION CHANNEL | ▨ FILLED AND CAPPED SUBSIDENCE PIT |
| ■ BUILDING | | |

0 400 800 1600
SCALE IN FEET

CHEROKEE COUNTY KANSAS
Lawton Subsite
Alternative 4

Figure 5



LEGEND
 (B) BULLROCK
 (M) MILL SITE
 [] SHAFT
 [] BUILDING
 S SUBSIDENCE PIT
 (X) TEST PIT
 [] MILL WASTE
 [] DIVERSION CHANNEL
 [] MILL WASTE CAPPED IN PLACE
 [] ON-SITE RETENTION POND
 [] CLEANED OF WASTE MILL
 [] FILLED AND CAPPED SUBSIDENCE PIT
 [] EXCAVATED STREAM CHANNEL
 [] EXCAVATED MILL WASTE
 [] EROSION CONTROL SEDIMENT DETENTION BERM
 [] ON-SITE REPOSITORY (NOT TO SCALE)
 CHEROKEE COUNTY KANSAS
 Waco Subsite
 Alternative 6
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 SCALE IN FEET
 Figure 6

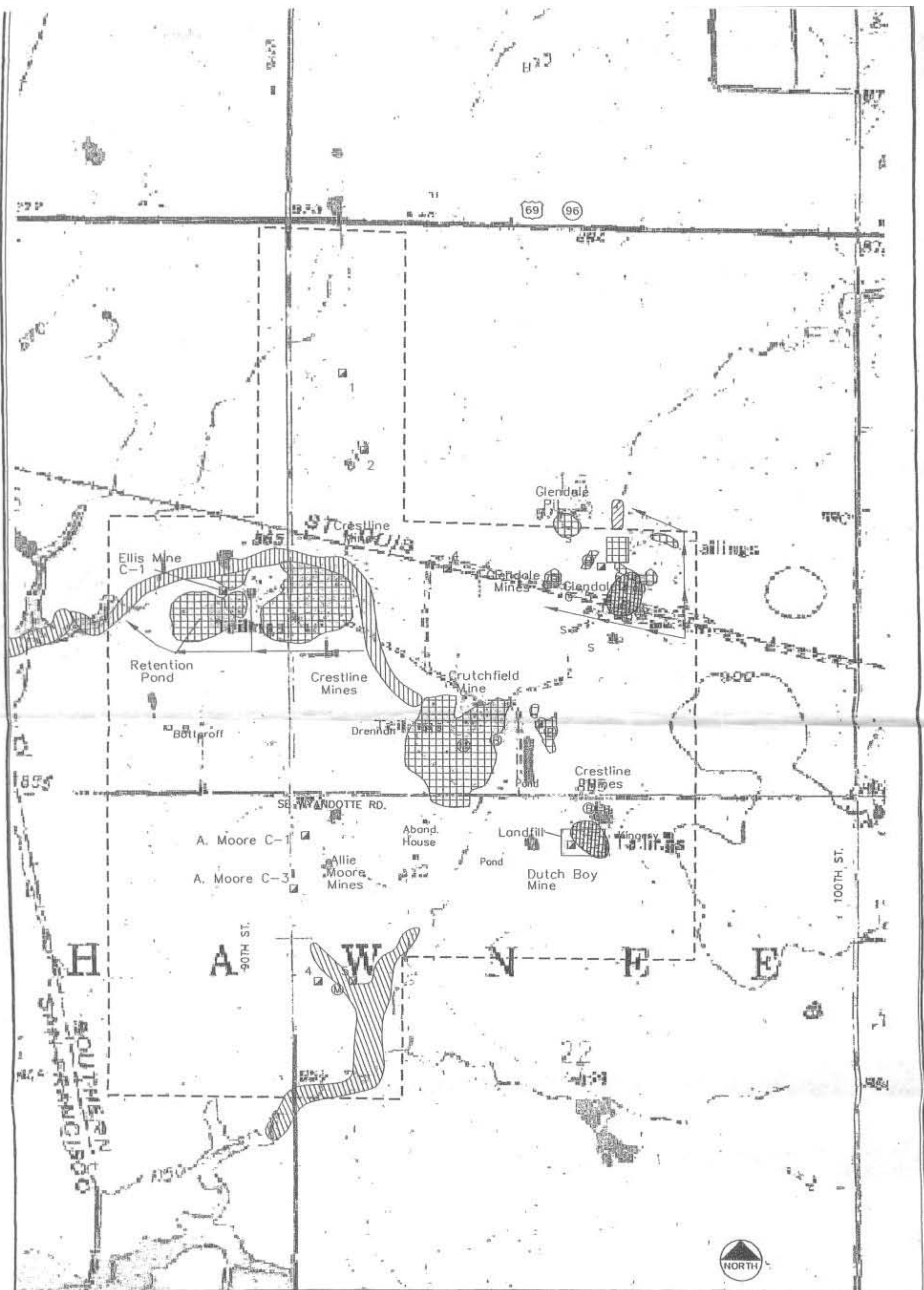


TABLE 1
REMEDIAL ACTION OBJECTIVES (RAOs)

Soils and Source Materials RAOs

1. Prevent human ingestion of contaminants of concern from on-site soils or source materials that would potentially result in cancer risks greater than 1.0×10^{-6} , non-carcinogenic hazard indexes greater than 1, or blood lead levels causing unacceptable human health risks. Soils or source materials containing less than 800 parts per million (ppm) lead and less than 75 ppm cadmium are deemed acceptable for preventing these potential human health risks.
2. Prevent the exposure of biota to contaminants of concern in materials that would potentially result in excessive ecological risks.

Surface Water and Sediment RAOs

1. Prevent exposure of biota to surface waters exceeding Kansas Aquatic Life Criteria and sediments exceeding MacDonald Threshold Effects Concentration (TEC) values, or background sediment values, resulting from the release and transport of contaminants of concern from mine wastes within the subsites.
2. Prevent risks to biota by controlling the erosion and transport of mine wastes and impacted sediments.

Groundwater RAOs

1. Prevent human ingestion of contaminants of concern in subsite groundwater at concentrations exceeding the National Primary and Secondary Drinking Water Standards.
2. Prevent exceedances of drinking water standards caused by the downward migration of site-related groundwater from the shallow Boone Aquifer to the deep Roubidoux Aquifer.
3. Prevent the discharge of groundwater containing site-related contaminants of concern that would result in exceedances of surface water and sediment criteria or cause excessive ecological risks.

TABLE 2
SUMMARY OF POTENTIAL CLEANUP ALTERNATIVES

No.	Description	Effectiveness	Implementability	Cost
1.	No Further Action <ul style="list-style-type: none"> - Implement institutional controls to reduce soils, source materials, and groundwater risks. 	Would effectively address potential human health risk because institutional controls are being implemented site-wide. Would not be effective in addressing surface water RAOs or risks.	Readily implementable.	Capital and O&M Costs: less than \$500,000.
2.	Water Management and Erosion Controls <ul style="list-style-type: none"> - Implement institutional controls to reduce soils, source materials, and groundwater risks - Detain on-site runoff in constructed pond - Divert clean runoff away from affected areas - Excavate ephemeral stream sediments - Stabilize eroding waste piles with soils or biosolids and revegetate - Abandon deep wells. 	Effective in reducing metal and sediment loadings to surface waters. However, would probably not achieve ARARs in all state-listed ephemeral streams. Periodic ARARs exceedances in classified streams and rivers would still occur due to upstream sources.	Readily implementable.	Capital and O&M Costs: less than \$3,000,000.
4.	Source Removal and Subsidence Pit Disposal <ul style="list-style-type: none"> - Implement institutional controls to reduce soils, source materials, and groundwater risks - Excavate ephemeral stream sediments - Excavate source materials to meet ARARs in state-listed ephemeral streams - Dispose excavated wastes in on-site subsidence Pits with soil covers - Revegetate excavated areas - Perform drainage and erosion controls, as prescribed in Alternative 2 - Abandon deep wells. 	Effective in reducing metal loadings and possibly meeting ARARs in state-listed ephemeral streams. Placing mill waste in the under-ground workings permanently removes the wastes from the aboveground environment. Periodic ARARs exceedances in classified streams and rivers would still occur due to upstream sources.	Technically implementable. However, EPA and state approval is partially dependent on the results of field demonstrations. Hence, the administrative implementability is somewhat uncertain.	Capital and O&M Costs: \$5,000,000.
5.	On-Site Containment and Drainage and Erosion Controls <ul style="list-style-type: none"> - implement institutional controls to reduce soils, source materials, and groundwater risks - Excavate ephemeral stream sediments - Consolidate chat and tailings deposits on site sufficient to meet ARARs in listed streams - Revegetate excavated areas - Cap consolidated waste piles with soil cover systems - Perform drainage and erosion controls, as prescribed in Alternative 2 - Abandon deep wells. 	Effectiveness is dependent, in part, on cover design and cost. Cover systems can be designed to achieve and maintain ARARs in state-listed ephemeral streams. Periodic ARARs exceedances in classified streams and rivers would still occur due to upstream sources.	Readily Implementable. Hydrologic modeling can be used to predict percolation rates for different cover designs.	Capital and O&M Costs: \$5,000,000.
6.	Source Removal and Aboveground Disposal <ul style="list-style-type: none"> - Implement institutional controls to reduce soils, source materials, and groundwater risks - Excavate ephemeral stream sediments - Excavate all mill wastes within the subsites and disposal in engineered repositories, subsidence pits, or revegetate in-place - Revegetate excavated areas - Perform drainage and erosion controls, as prescribed in Alternative 2 - Abandon deep wells. 	Despite extensive source removal, this alternative is deemed no more effective than Alternatives 4 or 5. Periodic ARARs exceedances in classified streams and rivers would still occur due to upstream sources.	Implementable, but this alternative would require large soil borrow areas to build the on-site repositories. Adequate cover materials may not be available.	Capital and O&M Costs: more than \$10,000,000.